

**Missouri Department of Higher Education**

**Curriculum Alignment Initiative**

**Report to**

**The Coordinating Board for Higher Education**

*Adopted by the Coordinating Board for Higher Education*  
*June 12, 2008*

The following motion was approved unanimously by the CBHE:

**It is recommended that the Coordinating Board for Higher Education approve the Curriculum Alignment Initiative report, with recognition of the dynamic nature of competencies.**

**It is further recommended that the board direct the Commissioner of Higher Education to make the CAI Report available online to interested government agencies and constituents as evidence of MDHE's significant progress in fulfilling its statutory requirements.**

**It is also recommended that the Coordinating Board for Higher Education commend the arduous efforts undertaken by the participants and educational institutions involved in the CAI process.**

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## **1. Introduction**

This document reports the mission and progress of MDHE's Curriculum Alignment Initiative (CAI) from inception in June 2007 to present. Further background information can be found at: [www.dhe.mo.gov/casinitiative.shtml](http://www.dhe.mo.gov/casinitiative.shtml).



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### **Statement from the Commissioner of Higher Education**

In Missouri and throughout the Nation, it has become increasingly clear that many high school students lack the preparation necessary for a successful transition from secondary to postsecondary education. The gap that exists creates the need for extensive remedial education, and presents unnecessary barriers to prospective collegiate students wanting to better themselves through increased educational attainment. To a lesser extent, persistence to undergraduate graduation is also affected by successful transfer of credit for students who attend more than one collegiate institution.

As part of the higher education omnibus bill (SB 389) passed by the Missouri legislature in May 2007, the transition from secondary to postsecondary education as well as the movement of college students from one collegiate institution to another were established as priorities for work of the Missouri Department of Higher Education (MDHE).

In anticipating the bill's passage, MDHE staff immediately began establishing the necessary ground work to get a new Curriculum Alignment Initiative (CAI) underway. For the past year, approximately 400 college faculty and administrators, secondary school teachers, and representatives from both the Department of Elementary and Secondary Education and MDHE have worked collaboratively in developing a competencies model that defines the skills and knowledge that should be mastered by high school graduates to be successful in beginning collegiate courses in key disciplines as well as competencies that should be mastered when completing these first courses to ensure their transferability for mobile students.

The work has been arduous, time consuming and challenging, especially since consensus is being sought with representatives from different institutions and educational sectors. A common frame for all participants, however, has been a passion for teaching and learning and a belief in the importance of this work for all students. The attached report includes both entry- and exit-level competencies for first courses in key general education disciplines and outlines next steps in the process of ensuring alignment with K-12 and transferability of academic credit. While the CAI framework has emphasized minimal competencies, work is also being completed on optimal competencies for student pathways that will lead to careers in many professions.

By its very nature, a competencies model must be dynamic and will require periodic review and revision to stay current. It will also require aligned assessments to be effective. At the same time the foundation that has been established by these initial competencies will have significant impact on Missouri's students and demonstrates a responsiveness of our higher education system to the demand for more accountability.

On behalf of the Coordinating Board for Higher Education and the Missouri Department of Higher Education, I express gratitude and deep admiration to the dedicated educators who have steadfastly worked on this project.

Robert B. Stein  
Commissioner of Higher Education  
June 2, 2008

### **3. Curriculum Alignment Initiative**

#### **Background**

Senate Bill 389, passed in 2007 (Appendix A, page 18), directed public colleges and universities to work with the Commissioner of Higher Education to develop entry- and exit-level competencies for beginning general education coursework. In order to fulfill these mandates the MDHE Curriculum Alignment Initiative (CAI) was established. CAI is composed of the Curriculum Alignment Steering Committee (CAS) and seven voluntary educator workgroups in each of the following academic disciplines:

- Arts and Humanities
- Engineering and Technology
- English and Communications
- Foreign Languages
- Mathematics
- Sciences
- Social Sciences

Each disciplinary workgroup was charged with identifying the first general education courses in their discipline and developing both broad disciplinary entry- and course exit-level competencies. The CAS was charged with coordinating the work of the seven disciplinary groups and identifying policies and procedures to ensure full implementation by public colleges and universities (independent institutions will be encouraged to review and utilize these competencies as well).

The work of the CAI is part of the MDHE strategy to increase participation in higher education and to smooth pathways for students entering into and progressing in higher education. The goal of this work is to improve the college readiness of high school students throughout Missouri, by clearly articulating what it means to be college ready, and to smooth the transfer of entry-level collegiate courses when students move from one institution to another. CAI is also driven by the work of the Mathematics, Engineering, Technology, and Science (METS) Coalition, as well as the P-20 Council and the Director of Education and Workforce Innovation.

#### **CAI Vision**

Collaboratively develop a competencies model for beginning-level general education that ensures student preparedness for collegiate-level coursework and portability of beginning general education course credit among Missouri postsecondary institutions.

#### **Points of Transition**

A central concept in the development of the CAI was the recognition that dependence on a single continuum as a foundation was inadequate. Reliance on course titles and credits is not sufficient as increasing numbers of entering students require remediation or do not successfully persist and complete college.

CAI sought to delve under the surface of alignment as merely requiring that the first course in college pick up where the last course in high school left off. There had to be an anchor to which K-12 educators and students could confirm college readiness and from which postsecondary faculty could move forward. The intent of entry-competencies is to form a line of demarcation between secondary and postsecondary level work.

While development of entry competencies recognized content knowledge and skills were of critical importance, it was also clear that competencies crossing the discipline areas were an important element in adequate preparation. Knowledge and skills that cross the disciplines, such as critical thinking and study habits, create a foundation on which other specific content skills may be built. Fostering collective responsibility for these skills will ensure their integration into adequate college preparation.

Exit competencies align more clearly with the traditional course system by their basis in the course-level unit of analysis. However, exit competencies do not seek to uncover the competencies traditionally suggested by course title alone, and instead delineate the specific competencies students should master upon successful completion of that course.

This approach seeks to uncover those areas where assumptions by multiple educational systems and sectors about a single concept (e.g. college readiness, general education course credit), while well intentioned, have contributed to misalignment in the P-20 pipeline. CAI seeks to bring a diverse group of educators to the table to articulate and center common definitions for these important points of educational transition.

## **Competencies Model**

For a student to be successful upon entrance into collegiate-level coursework and beyond, it is critical for that student to become responsible for and master a set of competencies that prepares them to learn in the college setting. To realize this ideal, a major paradigm shift will be necessary.

There are several steps involved in shifting to an effective competencies model:

1. Articulate implicit expectations for students entering into and exiting from higher education courses. By establishing clearly expected norms, expectations will be raised for students who aspire to enter college.
2. Link the competencies to assessment, ensuring that the CAI work does not simply end up on a shelf.
3. Identify policy implications in key areas (e.g. dual credit; remediation/developmental education; transfer policies) to reinforce policy alignment.
4. Stipulate an agreed-upon implementation schedule for competencies standards as well as any related policy revisions, for a smooth transition.

## **Assumptions**

The process of shifting to a competencies model approach is one that is based on several important underlying assumptions.

- This process will undertake a fundamental shift of multiple dimensions, (e.g. standards, curriculum, assessment, and policy) as well as having an impact across the P-20 continuum and its constituents (e.g. K-12, postsecondary, policy makers, administrators, educators, students, and families).
- Genuine systems change takes a significant time investment; however, to make progress responsible, earnest, and realistic timelines are necessary.
- Mastery of entry-level competencies will not be adequate for many students who aspire to professional careers, especially in mathematics, engineering, technology, and sciences (METS). In many fields, a basic level of preparation may be neither desirable nor sufficient for prefer
- red institutional admission, persistence, timely completion, and successful entry into a profession.
- Delivery modes, while important, are outside the realm of CAI to dictate instruction at the institutional level; a balance between content and instructional practice should be maintained for optimal student learning.
- The CAI should be a dynamic model that will be continually be updated for currency and relevancy.

## **Relation to Institutional Selectivity**

Admissions selectivity categories at Missouri public institutions vary across the state from open enrollment to highly selective institutions. Institutions maintain the right to choose both their level of selectivity based on institutional mission and purpose and develop curriculum suitable to their student body. This tiered admission selectivity provides a balanced public higher education system which serves a diverse group of entering students. There is, however, collective responsibility across public postsecondary institutions to send consistent and forceful messages to students in the pipeline about what is necessary in preparation for college. While entry and exit points for a course may differ slightly depending upon the preparation levels of entering students, as a result of this work those in the pipeline will have a much better understanding of minimum thresholds necessary for access to collegiate work. Some students may in fact start at a different level and bypass that first course completely. Developing a common framework for beginning general education courses will also ensure the transferability of these courses across collegiate-level institutions.

By putting multiple institutions at the table simultaneously, CAI is looking for commonality on minimal thresholds. At the same time, it seeks to provide institutional flexibility to make local decisions about placement of both underprepared and prepared students. The diagram below is presented as a graphic illustration of an operational conceptualization representing the way the process would work once implemented.

Note the thick black line at bottom of the diagram. This is intended to represent a dividing line between underprepared and prepared students by establishing minimal thresholds that must be met in order to be given access to collegiate level courses. The arrows down represent consistant messages to K-12 students. Those who are unable to demonstrate minimal competencies as high school graduates would be placed in developmental courses to address deficiencies.

Students who enter above the minimal threshold would undergo placement decisions by the local institution depending on their level of preparation. The two axes in the diagram represent the type of competencies that students would master in their first course in the discipline. The vertical axis represents content based skills in a particular discipline while the horizontal axis denotes those transferable skills that are acquired across the disciplines, such as study skills or critical thinking.

Mathematics is used for illustrative purposes in the diagram. The three boxes in the diagram are intended to represent a college algebra course at institutions with different admission selectivity (*solid* for open enrollment, *dotted* for moderately selective and *striped* for selective and highly selective). It is important to note, that each institution, including open enrollment institutions, would have flexibility at where to start and how far they would take students in the learning process. The diagram, however, represents typical patterns that would be expected from the CAI competencies model.

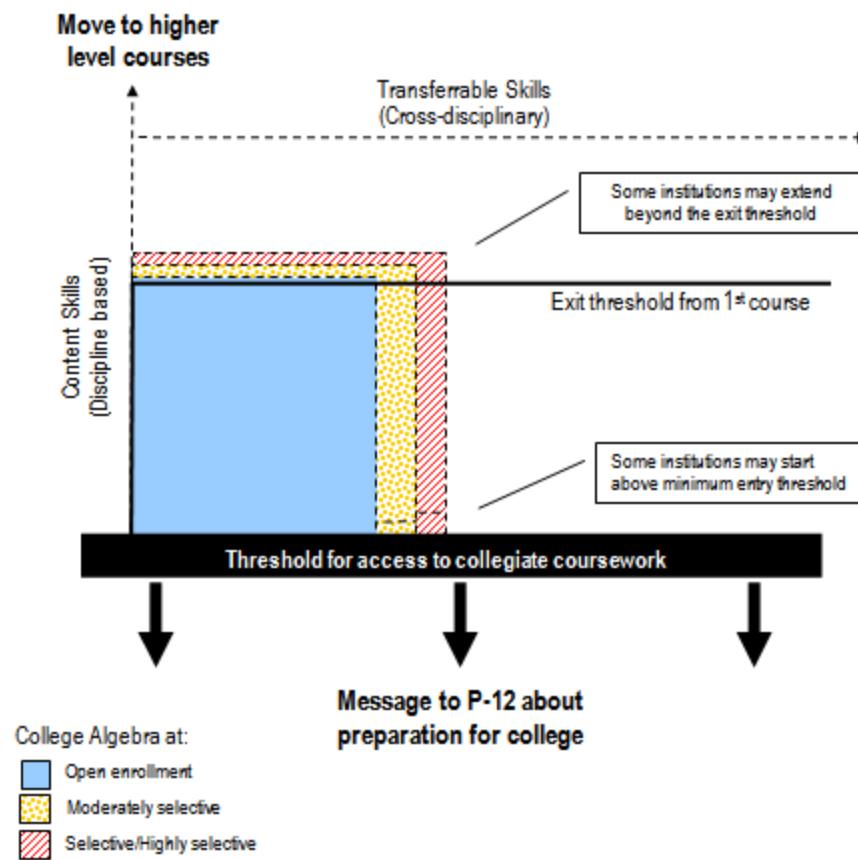
The *solid* box is the smallest, in this case, since students would be expected to start at the minimal competency level. On both the vertical and horizontal axes, *solid* courses would be expected to bring students to minimum exit-level competencies including the content skills (vertical axis) and cross disciplinary skills (horizontal axis) mastered<sup>1</sup>. Courses at *dotted* and *striped* institutions would cover all of the material in the *solid* box and beyond. Students in these courses might in fact achieve beyond minimal competencies identified on both axes; thus, the dotted line indicates the potential for different start and exit points based on the preparation level of entering students and the course dynamics during a particular semester.

The model assumes that a student body that enters just at the threshold for access to collegiate-level course work will focus most of their attention on mastering the content knowledge. While notable gains in their transferable skills will also be realized, much of the course time will be spent on purely content-related tasks. At higher selectivity-level institutions, greater gains would be expected for both content and cross-disciplinary skills. The student body that has the ability to start beyond the threshold point and/or easily master the content knowledge will have more course time devoted to deepen conceptual understanding and develop transferable skills, such as critical thinking or writing.

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<sup>1</sup> The CAI exit-level competencies are only content based.

## Entry- and Exit-Level Competencies for 1<sup>st</sup> College Course Across Diverse Institutions



## 4. CAI Competencies

### Entry-Level Competencies

#### *Completed Disciplinary Entry-Level Competencies (Entry-Cs)*

Entry-Cs are meant to outline the minimum threshold for success in collegiate-level coursework. Disciplinary competencies include Arts and Humanities; English and Communication; Foreign Languages; Science; and Social Sciences. A complete set of the Entry-Cs can be found in Appendix B (page 19).

During the process several characteristics of the competencies, or essential skills and knowledge, emerged.

The Entry-Cs vary in their level of detail dependent upon both the nature of the competency and discipline. For example, the hierarchical nature of mathematics would require a student be able to “Recognize and generate equivalent forms of fractions, decimals, and percents” (Mathematics Entry-Cs, I.3.), while the continuum nature of English allows more generalized competencies such as “Use a variety of sentence structures correctly” (English and Communication Entry-Cs, 3.a.) when describing sentence competences.

All the disciplines utilized a similar structure in the overall organization of the Entry-Cs. Many of the Discipline Workgroups provided a preface that outlined the rationale and resources as well as the conceptual approach used in development of competencies. In addition, the workgroups utilized a stem sentence with a lead into more specific and measurable statements of knowledge and skills expected, with variation in level of detail. This approach is represented in the General Life Sciences Entry-Cs (I.1.a.i-iv.) example below.

Example from the Science Entry Competencies:

#### General Life Sciences Competencies

- 1) Science understanding is developed through the use of scientific investigation, reasoning, and critical thinking.
  - a) Scientific inquiry requires the ability to gather and analyze information and ideas.
    - i) Apply sound library research skills (e.g., article searches, online databases).
    - ii) Evaluate a given source for its scientific credibility (e.g. web sites, product advertisements, use of personal testimony in place of scientific evidence, etc.).
    - iii) Read with comprehension and be able to summarize and draw conclusions from written material in basic science.
    - iv) Interpret data using various representations (e.g., graphs, tables, charts, and plots).

### *Cross-Disciplinary Competencies*

It became clear early in the CAI work that there was a need to also develop cross-disciplinary competencies considered to be fundamental for student success. Cross-Disciplinary Competencies serve as a foundation for content knowledge across the disciplines.

The draft Cross-Disciplinary Competencies can be found in Appendix C (page 42) and are organized into three areas:

1. Key Cognitive Skills or “Habits of Mind” (e.g. critical thinking, positive work habits)
2. Reading and Writing
3. Technology and Information Literacy

Cross-Disciplinary Competencies are currently undergoing revisions and will be placed on a one-month public comment period in mid-June 2008.

### **Optimal Entry Competencies**

The entry-level competencies developed by the discipline workgroups denote the minimum entry competencies for students wishing to pursue higher education. Many fields require additional preparation for successful and timely completion. For example, if a student is interested in a professional career in foreign languages, taking additional language and culture classes in high school would be essential. Students should seek to increase both the breadth and depth of knowledge in their potential fields of interest. Optimal competencies for entrance into professional practice fields should be layered on top of the minimal competencies to ensure students in the pipeline have accurate understanding of competencies needed for their chosen career.

#### *Mathematics, Engineering, Technology, and Science (METS) Optimal Entry Competencies*

The need for additional preparation is particularly clear in METS fields. The competencies needed for adequate preparation upon entrance into and for successful persistence in college for most METS fields are higher than the minimum competencies for access to beginning collegiate-level general education coursework.

Workgroups have developed competencies for optimal entry into engineering and math as well as engineering and information technologies, with science fields soon to follow. These competencies are currently undergoing a public comment period set to end in early July 2008. Revisions will be made based on feedback received. Draft optimal entry competencies can be found in Appendix D (page 50).

### **Exit-Level Competencies (Exit-Cs)**

Exit-Cs address the core competencies students should have mastered upon completion of a beginning general education course. A prioritized set of 13 courses was used to develop competencies from across the disciplines. This list was generated based on the foundational nature of courses and/or the preponderance of freshman enrollment. Future work will include

development of additional Exit-Cs for other beginning general education courses, in accordance with the mandate of Senate Bill 389. The exit-level competencies can be found in Appendix E (page 58).

Variation in Exit-Cs was affected both by the nature of the discipline and the delivery of the course across Missouri institutions.

The level of detail exhibited in the Exit-Cs could most often be attributed to the prevalence of essential core components within a course. For example, Introduction to Philosophy can be taught from either a historical or conceptual perspective, and the intent was to accommodate both in the competencies “Students will identify the major areas of philosophy and explain and analyze some of the major philosophical problems in several of these areas” (Introduction to Philosophy Exit-Cs, 1). In contrast, other courses contain much more specific knowledge that must be imparted as an essential element, for example the Missouri state requirements in government, and are reflected in the government competencies “Explain what the Electoral College is and how it works.” (American Government Exit-Cs, II.4.c).

Like entry-level competencies, the structure of Exit-Cs utilized a stem sentence with a lead into more specific and measurable statements of knowledge and skills expected. The foreign languages example (Foreign Language Exit-Cs, IV.1-2.) below exhibits this approach.

Example from the Foreign Language Exit Competencies:

IV. Speaking

- 1) Describe self with some hesitation using memorized words and phrases and can ask and answer simple questions on familiar topics such as self, family, and immediate surroundings.
- 2) Use simple phrases and sentences to describe where they live and people they know, making themselves understood by a sympathetic native speaker.

### **Competencies Report Release**

The entry- and exit-level competencies outlined in this report will be made widely available to all constituencies in both print and electronic format. Print documents will include summary information while more detailed competencies and examples will be available in a web format.

These competencies are meant to communicate collegiate coursework expectations, to raise students’ awareness of college readiness, and to encourage students—and all educational stakeholders who advise students—to select appropriate and rigorous coursework for future career and college success.

## **5. Public Policy Implications**

The initial work of the CAI is the first step in a process designed to smooth the transition points of students embarking on postsecondary education. As part of a greater strategy to smooth the educational pipeline, its impact on a number of public policy issues has tremendous potential to improve student preparation and increase success. The following represent several of the issues that will be addressed as work continues to progress on the CAI.

### *General Education Policy*

In order to facilitate the transfer of students among institutions of higher education in the state, the CBHE supported the development of a statewide general education policy that ensures the portability of general education credit among Missouri's colleges and universities.

The model is structured on four general education knowledge (Social and Behavioral Sciences, Humanities and Fine Arts, Mathematics, and Life and Physical Sciences) and skill (Communicating, Higher Order Thinking Managing Information, and Valuing) areas with illustrative competencies. Students who complete a 42-hour block of general education credit have had opportunity to achieve the expectations outlined and the block is considered equivalent to corresponding blocks of credit at other public institutions and participating independent and proprietary institutions.

Institutions are committed to align their general education programs with this block of credit and faculty at each institution develops and teaches courses in a general education program in keeping with the knowledge and skill areas. The development of CAI exit level competencies for individual courses in general education has been guided by faculty and builds upon the foundation of goals and suggested competencies identified in the general education program policy. Based on the mandate of Senate Bill 389, exit competencies within individual general education courses will now be considered equivalent to corresponding credit at other public and participating independent and proprietary institutions. While institutions will continue to develop course and program articulations, transfer of general education course credit will now be ensured based upon having satisfied the exit competencies for a particular beginning general education course credit, in the absence of the 42-hour block.

In order to illustrate the relation between the General Education Policy competencies and the exit competencies developed for the first general education courses, CAI workgroups have developed a set of matrices comparing the illustrative general education 42-hour block competencies with each of the 13 course exit competencies. In the example below, one of the illustrative competencies from the Communicating area of the general education policy is aligned with corresponding competencies from the Freshman Composition Exit-Cs.

Example from General Education Illustrative Competencies/Freshman Composition Matrix:

**a. Communicating**

State-Level Goal: To develop students' effective use of the English language and quantitative and other symbolic systems essential to their success in school and in the world. Students should be able to read and listen critically and to write and speak with thoughtfulness, clarity, coherence, and persuasiveness.

<b>Illustrative General Education Competency</b>	<b>First Course: Freshman Composition Sequence</b>
analyze and evaluate their own and others' speaking and writing. conceive of writing as a recursive process that involves many strategies, including generating material, evaluating sources when used, drafting, revising, and editing.	1.g: Analyze and evaluate their own and others' speaking and writing 2.d: Communicate with few errors in grammar, usage, diction, and mechanics 3.d: Select and use appropriate patterns of organization for subject audience, and purpose <b>4—Understand and use a recursive writing process to develop strategies for generating, revising, editing, and proofreading texts</b>

A sample matrix for General Education Illustrative Competencies and Freshman Composition Exit Competencies is available in Appendix F (page 83). The complete set of matrices for the 13 course exit competencies will be available with the public web release.

*Assessment*

Dialogue and decisions regarding assessment will be mindful of the purpose, process, & commitment of institutions and educators to implement standards and revised policy, as well as newly adopted measures. Assessment instruments will respect differences among institutional missions, faculty flexibility & autonomy, and the multiple dimensions of distinct disciplines and student learning.

*Placement*

The placement of students into college-level or developmental (remedial) coursework is among the most significant issue that the CAI impacts. There is currently no statewide policy regarding access to collegiate-level coursework.

The lack of a consistent message for entering students has contributed to growing numbers of underprepared students placing into remediation. Increased percentages of high school graduates attending college may be another factor. The threshold for placement into credit-bearing courses at Missouri public institutions varies widely, adding to the confusing messages currently sent to college-bound students

Through CAI entry-level competencies, a statewide placement policy will be developed. This policy will establish the threshold for access to collegiate-level coursework and will enable public institutions in Missouri to speak collectively to educators, students, and parents about the necessary minimum levels of preparation for beginning college courses.

The driver for this placement policy will be assessment. Collaborative development and decisions will be necessary to develop appropriate assessments. Selection of appropriate entry competencies for assessment as well as decisions about assessment instruments will accompany placement policy development.

#### *Transferability without the 42-Hour Block of Credit*

CAI is mandated through Senate Bill 389 to develop course-level exit competencies in beginning general education coursework. The intent of this work is specifically to ensure transfer of these courses across all public institutions in Missouri.

Statewide General Education Policy currently allows for transferring a 42-hour core of general education coursework as a block. Other credit transfer guidelines in place suggest good practice approach to credit transfer but do not mandate acceptance of specific course credit.

Work is already underway to align exit competencies with the knowledge and content areas of the already approved forty-two hour block of general education credit that is part of the statewide articulated Associate of Arts degree. These alignment efforts with general education policy already in place will facilitate integration across Missouri institutions.

Future policy development will require collaborative development of assessment procedures that define satisfactory achievement of exit competencies while recognizing variation in course delivery. Policy will also specifically summarize courses accepted in transfer across Missouri public institutions and outline procedures for acceptance.

#### *Dual Credit*

CAI will directly impact two central areas of dual credit policy, student eligibility and assessment of student performance. Revisions to the policy will reflect the minimum threshold for access to collegiate level coursework. In addition, it will also be necessary to integrate policies regarding assessment of exit competencies upon course completion.

#### **Implementation**

Discussions regarding assessment and implementation will be ongoing to develop reasonable expectations and phase-in models to allow for student success while raising student expectations. This, like other aspects of the CAI, will continue to be a collaborative process that will seek to involve all constituents.

## **6. Partnerships**

### **K-12 Education**

The CBHE, the Missouri Department of Higher Education (MDHE), Missouri postsecondary institutions, and the Missouri K-12 community share a common interest in promoting adequate student preparation as a foundation of enrollment, retention, and success in Missouri postsecondary institutions.

Accordingly, with collaboration across educational sectors, the CBHE has established a recommended 24-unit high school core curriculum guideline for students who plan to enroll in a Missouri college or university that is aligned with the State Board of Education requirements for graduation from Missouri high schools.

Higher education and K-12 representatives recognize the potential impact of this work of defining entry level competencies to strengthen P-20 education, impact changes and revisions to K-12 education, and changes to higher education. By having a unified and common focus of what Missouri expects students to know and be able to do upon entering higher education, CAI will clarify the roadmap K-12 education utilizes in preparing students for higher education. Representatives respect the goal of this committee to also develop exit competencies, address the issues of transferability, and the huge and significant undertaking of curriculum alignment across the secondary/postsecondary interface.

### *Concurrent Mathematics Competencies Development*

Concurrent work in mathematics K-12 standards revisions recommended by the METS Coalition is underway at the Department of Elementary and Secondary Education. A gap analysis of the two sets of competencies has been performed to illuminate similarities and differences in the documents. The Mathematics Discipline Group Liaisons met with their K-12 counterparts to consider the gap analyses performed and to dialogue about next steps.

### **Business and Industry Partnerships**

It is the intent of the CAI to consider alignment between postsecondary education entry competencies and those needed for all postsecondary options. Recognizing the importance of extending a consistent message for all students, not just those immediately entering higher education, CAI endeavored to seek additional input from the business community regarding entry competencies. Currently underway is a survey to business leaders who belong to the Department of Economic Development's (DED) Industry Councils asking for feedback on essential competencies for students entering into the workforce directly from high school.

In addition, the MDHE is participating with DED on a project to outline competencies in occupations for eight of the state's priority industry clusters. This work will eventually provide tools for the CAI (and Missouri postsecondary institutions) to consider competencies in light of industry needs.



## **Appendix A: Senate Bill 389 on Curriculum Alignment**

### **Senate Bill 389 (SB 389), Language on Curriculum Alignment**

The coordinating board shall establish guidelines to promote and facilitate the transfer of students between institutions of higher education within the state and shall ensure that as of the 2008-2009 academic year, in order to receive increases in state appropriations, all approved public two- and four-year public institutions shall work with the commissioner of higher education to establish agreed-upon competencies for all entry-level collegiate courses in English, mathematics, foreign language, sciences, and social sciences associated with an institution's general education core and that the coordinating board shall establish policies and procedures to ensure such courses are accepted in transfer among public institutions and treated as equivalent to similar courses at the receiving institutions. The department of elementary and secondary education shall align such competencies with the assessments found in section 160.518, RSMo, and successor assessments;

## **Appendix B: Entry Level Course Competencies**

Included Entry-Level Competencies:

- |                                   |    |
|-----------------------------------|----|
| 1. Arts and Humanities.....       | 20 |
| 2. English and Communication..... | 22 |
| 3. Foreign Languages.....         | 24 |
| 4. Mathematics.....               | 25 |
| 5. Science.....                   | 30 |
| 6. Social Science.....            | 39 |

## **Appendix B: Entry Level Course Competencies**

### **1. Arts and Humanities Entry Competencies**

Note: The first draft of the arts and humanities entry-level competencies contained primarily cross-disciplinary competencies. The original draft has been replaced with the arts competencies below. The original draft of the entry-level competencies will be incorporated into cross-disciplinary competencies developed across the discipline workgroups.

#### **Competencies for the Fine Arts**

These competencies constitute a body of what we consider the minimal level of essential knowledge and skills students should have acquired and be able to demonstrate based on experience in **one (selected)** fine arts discipline – dance, music, theatre, or visual arts, to certify that they are ready for entry-level college work in said fine arts discipline. Competencies listed below should be interpreted based on a single selected field. These entry level competencies would not apply in the event that a student graduated from a school district which did not offer or require fine arts opportunities.

#### **Essential Entry Level Competencies for the Fine Arts**

##### **I. Product and Performance**

- 1) Develop and apply skills of expression to communicate (perform/produce) through the arts by performing, creating, or producing works in visual/performance arts.
  - a) Dance: Move, perform, or read and notate dance.
  - b) Music: Sing or play an instrument, read musical notation.
  - c) Theatre: Interpret a role by reading a script or improvising.
  - d) Visual art: Create a two- or three-dimensional art piece.

##### **II. Elements and Principles**

- 1) Identify elements and principles for visual/performing art forms.

*Elements:*

- a) Dance: Energy/force, space, time.
- b) Music: Duration, intensity, pitch, timbre.
- c) Theatre: Scenario, script/text, set design.
- d) Visual art: Line, shape, color, texture, form, value, space.

*Principles:*

- e) Dance: Choreography, form, genre, improvisation, style, technique.
- f) Music: Composition, form, genre, harmony, rhythm, texture.
- g) Theatre: Balance, collaboration, discipline, emphasis, focus, intention, movement, rhythm, style, voice.
- h) Visual art: Balance, contrast, emphasis, rhythm/repetition, proportion, unity.
- i) Develop and apply knowledge and skills to read standard notation and/or discuss art works, musical or theatrical performances.

## **Appendix B: Entry Level Course Competencies**

### **III. Artistic Perceptions**

- 1) Communicate perceptions and ideas in selected art form using an arts-specific vocabulary.
- 2) Exchange information, questions, and ideas in the evaluation of works of art.

### **IV. Interdisciplinary Connections**

- 1) Discover and evaluate patterns and relationships within the visual arts and the performing arts.
- 2) Identify and explain ways in which the principles and subject matter of fine arts disciplines are interrelated to math, science, social studies and communication arts.

### **V. Historical and Cultural Context**

- 1) Recognize and explain how the fine arts are created in relation to major cultural, socio-political and historical periods.
- 2) Compare and contrast artworks from different historical time periods and/or cultures.

## **Appendix B: Entry Level Course Competencies**

### **2. English and Communication Entry Competencies**

#### **Entry-Level Competencies for First Course in Freshman Composition**

The following are the *writing, thinking and expressive* skills identified and recommended by our group of community college and four-year English instructors and professors as well as high school teachers of English. The competencies constitute a body of what we consider the minimal level of knowledge and skills students *should have acquired to certify* that they are ready for entry-level college work in English.

- 1) Demonstrate critical and analytical thinking for reading, writing, and speaking purposes.
  - a) Participate in active reading and discussion of texts.
  - b) Incorporate ideas and information from readings into own writing.
  - c) Identify purpose, main idea, and supporting evidence.
  - d) Distinguish between fact and opinion.
  - e) Distinguish between general and specific information.
  - f) Summarize and paraphrase information.
  - g) Communicate effectively in groups by listening, reflecting, and responding appropriately.
- 2) Understand and use a writing process.
  - a) Have flexible strategies for generating, revising, editing, and proofreading.
  - b) Understand writing as an open, flexible process that permits a writer to use later invention and rethinking to revise work.
- 3) Compose sound sentences.
  - a) Use a variety of sentence structures correctly (simple, compound, complex, and compound-complex).
  - b) Produce sentences free of major sentence-level errors (fragments, comma splices, fused-sentences).
  - c) Communicate with few errors in grammar, usage and mechanics.
- 4) Compose sound paragraphs.
  - a) Write focused topic sentences.
  - b) Use descriptive details, examples, and facts to develop the paragraph's main idea.
  - c) Use effective patterns of organization (e.g., chronological, emphatic, spatial, etc.). and development (e.g., comparison/contrast, narration, definition, etc.).
  - d) Use transitional devices within paragraphs to achieve coherence and focus.
- 5) Produce sound discourse.
  - a) Use basic essay structure, including an introduction, body, and conclusion.
  - b) Construct thesis statements.
  - c) Organize ideas logically.

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- d) Develop an essay's main idea with adequate and specific supporting detail.
  - e) Use transitional devices within essays to achieve coherence, flow, and focus.
  - f) Maintain appropriate tone and vocabulary for target audience.
- 6) Be familiar with elementary research procedures.
- a) Acknowledge source material and be able to distinguish it from their own ideas.
  - b) Locate and retrieve relevant information using traditional and contemporary technologies.
  - c) Evaluate reliability of information and sources.
  - d) Record relevant information.
  - e) Document sources of information, using recognized documentation format.

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### **3. Foreign Languages Entry Competencies**

Foreign Languages are specifically mentioned in Senate Bill 389 as one of the areas to be addressed by the Curriculum Alignment Initiative. The initial competencies developed as entry-level competencies for entry into postsecondary foreign languages reflected the minimum level of skill (not necessarily the optimal level). Because a foreign language is not a requirement for high school graduation in Missouri, initial competencies reflected general cross-disciplinary skills (e.g. grammar skills) needed for success in a first foreign language course. For this reason, these competencies are not considered just to be important to foreign languages, but to all of the discipline areas. Therefore, these competencies will be incorporated into a cross-disciplinary section that will anchor all of the entry competencies.

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### **4. Mathematics Entry Competencies**

Incoming college level students are expected to bring hands-on skills in computation and algebraic manipulation, as well as conceptual knowledge rooted in a deep and profound understanding of numbers and basic geometry. Incoming students are expected to know basic mathematical concepts in computation, algebra and geometry. These are described in some detail in following sections.

In addition, incoming students need to have a comfort level with mathematics so that they approach problems by investigating their nature, asking questions, and revising approaches as they reflect on them. It is as important to understand why a solution works as it is know how one reaches a solution.

Mastery of mathematics at all levels should include the following characteristics:

1. Thinking conceptually and not just procedurally about mathematics. Mathematics is a way of understanding, a thinking process, and not a collection of detached procedures to be learned and applied separately.
2. Using logical reasoning and common sense to work on problems in order to find solutions. Successful students can explain their processes and can check their solutions to see whether their findings make sense.
3. Using experimental thinking and a willingness to investigate the steps used to reach a solution, and recognizing that there are often multiple approaches to solving a problem.
4. Taking risks and accepting that a first or second attempt may result in a wrong answer, but that each attempt is an opportunity to try new approaches toward solving the problem.
5. Understanding that formulas and algorithms in computation, while important and crucial, are only part of the analytical process.

Successful incoming students understand that mathematical problem solving involves logical reasoning. Technology is important and relevant in understanding mathematics, but students should be aware of the limitations of technology and recognize that calculators and computers are tools to assist but not replace the thinking process. Students should understand the basic mathematical terminology and use it appropriately. Students must pay attention to the wording of problems and move with ease between the symbolic representation of a problem and its verbal representation. Students are expected to write with clarity and cohesiveness.

Successful students will also present an orientation toward learning that presents itself as a willingness to work for significant periods of time on a single problem. Persistence is invaluable in the quest for a solution to a problem. Sustained inquiry - engaging in the process for more than a short period of time - is an important part of the process when solving a problem. Oftentimes this process will help foster a deeper understanding, build confidence, and inspire learning.

Successful students demonstrate active participation in the process of learning mathematics by:

1. being willing to experiment with problems that have multiple solution methods;

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2. demonstrating an understanding of the mathematical ideas behind the steps of a solution, as well as the solution;
3. showing an understanding of how to modify patterns to obtain different results;
4. showing an understanding of how to modify strategies to obtain different results; and
5. recognizing when a proposed solution does not work, analyzing why, and using the analysis to seek a valid solution.
6. demonstrating an ability to solve multi-step problems with a variety of strategies.

In the sections that follow, entry level competencies have been detailed in areas of numerical computation, algebra and geometry. Examples demonstrating the levels of understanding needed will become a part of this document when they are completed. An asterisk by a number indicates that the competency listed is one that is expected of students who plan to major in METS areas of study.

### **I. Numerical Computation**

Conceptual understanding of these basic computations, although not explicitly stated (in the examples), is assumed. While technology is useful in helping students explore and enhance their understanding of basic computations, their ability to conceptually understand and perform basic computations without the aid of technology increases the likelihood of success in college level mathematics courses.

Successful students must be able to:

1. Apply mathematical operations to all real numbers in any form (including integers, rational numbers, radicals, and decimals), following the correct order of operations.
2. Calculate the sum, difference, product, and quotient of complex numbers and express the result in standard form.
3. Recognize and generate equivalent forms of fractions, decimals, and percents.
4. Compare and order real numbers, including finding their approximate locations on the number line.
5. Apply laws of rational exponents to real number bases.
6. Recognize and generate equivalent representations (i.e., scientific notation) for very large and very small numbers, and perform mathematical operations on such numerical representations. Move flexibly between scientific notation and expanded form.
7. Compute quantities involving absolute value.
8. Apply the properties of real numbers (including commutative, associative, identity, inverse, and distributive properties).
9. Perform numerical computations involving units of measurement, standard and metric.
10. Communicate accurately using mathematical terminology (e.g., addend, sum, difference, factor, product, divisor, dividend, quotient, remainder, numerator, denominator, exponent, base, radicand, and index).
11. Accurately record symbolic manipulations used in numerical computations, as well as the solutions of numerical computations (e.g., equal signs, inequality symbols, grouping symbols, exponents, subscripts, and solution sets).

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12. Communicate accurately using set notation/terminology (e.g., set-builder notation, element of, well-defined, finite/infinite, subset, proper subset,  $\emptyset$ , cardinal number, equal, equivalent, and interval notation).
13. Estimate numerical computations and judge the reasonableness of the results of these computations.
14. Apply set operations and relations to sets (i.e., union, intersection, complement, and subsets).
15. Represent sets using graphic organizers, including Venn diagrams.

### **II. Algebra**

Successful students are expected to bring a combination of hands-on skill and conceptual understanding of algebra.

- 1) Successful students know and apply basic algebraic concepts. They:
  - a) Add, subtract, multiply, and divide polynomials, rational expressions, and radical expressions.
  - b) Divide polynomials.
  - c) Apply properties of exponents and radicals.
  - d) Factor polynomials (e.g., greatest common factor, grouping, trinomials, difference of squares, sum and difference of cubes).
  - e) Simplify polynomials, rational expressions, and radical expressions.
- 2) Successful students use various appropriate techniques to solve basic equations and inequalities. They:
  - a) Solve linear equations and absolute value equations.
  - b) Solve linear inequalities and absolute value inequalities.
  - c) Solve systems of linear equations and inequalities with two variables, using algebraic or graphical methods.
  - d) Solve quadratic equations by factoring, completing the square, and using the quadratic formula.
  - e) Solve rational equations.
  - f) Solve radical equations.
  - g) \*Solve nonlinear inequalities. (Recall, an asterisk by a number indicates that the competency listed is one that is expected of students who plan to major in METS areas of study.)
- 3) Successful students distinguish among expressions, formulas, equations, functions and relations. They know when it is possible to simplify, solve, substitute or evaluate appropriately. In addition, they:
  - a) Correctly apply the algebraic language and notation for functions including domain and range.
  - b) Compose and decompose functions and find inverses of basic functions.
  - c) Identify and compare a variety of functions (e.g., constant, linear, quadratic, cubic, absolute value, exponential and logarithmic functions) and apply the properties of each.
- 4) Successful students understand the relationship between equations and graphs. They:
  - a) Recognize basic forms of the equation of a line and graph the line without technology.

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- b) Recognize the basic shape of the graph of a quadratic function; find the vertex; calculate and recognize the relationships among the solutions of the related quadratic equation, zeroes of the function and intercepts of the graph.
  - c) Recognize and sketch the basic shapes of the graphs of the following functions: constant, linear, quadratic, cubic, square root, cube root, absolute value, exponential and logarithmic (without technology).
  - d) Describe the effects of parameter changes on functions.
  - e) Describe and sketch the effects of transformations on the graphs of functions.
  - f) Represent data in a variety of ways (e.g. scatter plot, graph, and table) and select the most appropriate method.
- 5) Successful students understand algebra well enough to apply it procedurally and conceptually to a range of common problems. Successful students demonstrate the ability to work with formulas and symbols algebraically. They:
- a) Recognize which type of function or expression best fits the context of a basic application.
  - b) Use multiple representations to solve problems (e.g. analytic, numerical, and geometric).
  - c) Represent algebraically and solve problems that include linear, quadratic, exponential, and logarithmic relationships.
  - d) Use mathematics to solve applications from various fields (e.g. rates of change, compound interest, chemical mixture, population growth, and business).
  - e) Solve literal equations and formulas for a specified variable.
  - f) Communicate accurately using the vocabulary and symbols of algebra.
- 6) Successful students understand the appropriate use, as well as the limitation, of appropriate technology. They:
- a) Plot relevant graphs.
  - b) Use appropriate problem solving methods.
  - c) Recognize when the results produced are unreasonable or represent misinformation.

### **III. Geometry**

Successful students must possess a basic body of knowledge including but not limited to the Pythagorean Theorem, formulas for perimeter, area, volume, and surface area. Successful students demonstrate an understanding of and can explain the mathematical ideas behind the steps of a solution as well as the solution. Successful students recognize when a proposed strategy does not work, analyze why, and use the analysis to seek a valid solution. Successful students understand the appropriate use as well as the limitations of technology.

Successful students must be able to:

- 1) Apply properties of similarity and congruence.
- 2) Recognize and apply properties and theorems of parallel lines cut by a transversal.
- 3) Recognize and apply properties and theorems related to circles.

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- 4) Determine the area and perimeter of plane figures and use the concept of conservation of area.
- 5) Apply the basic formulas for volume and surface area of solids.
- 6) Use deductive reasoning to develop and write simple geometric proofs.
- 7) Use inductive reasoning in problem situations to build a basis for the use of both proof and counter-examples.
- 8) Apply properties of similarity, particularly related to triangles, to find unknown geometric measurements including angle measurements, lengths of sides, areas, and volumes.
- 9) Recognize and represent solids and surfaces in three-dimensional space from a two-dimensional representation (e.g. recognize the features of a three-dimensional object: faces, edges, vertices, and shape).
- 10) Use coordinate geometry to make connections between algebra and geometry.
  - a) Describe lines in the coordinate plane using slope-intercept and point-slope form.
  - b) Use slopes to describe the steepness and direction of lines in the coordinate plane and to determine if lines are parallel, perpendicular, or neither.
  - c) Relate geometric and algebraic representations of lines, segments, simple curves, circles, and \*conic sections. (Recall, an asterisk by a number indicates that the competency listed is one that is expected of students who plan to major in METS areas of study.)
  - d) Derive and use the formula for distance between two points.
- 11) Apply the definitions of sine, cosine, and tangent using right triangle trigonometry and \*similarity relations. (Recall, an asterisk by a number indicates that the competency listed is one that is expected of students who plan to major in METS areas of study.)
- 12) \*Use trigonometry for examples of algebraic/geometric relationship, including the Law of Sines/Cosines and Trigonometric Identities. (Recall, an asterisk by a number indicates that the competency listed is one that is expected of students who plan to major in METS areas of study.)
- 13) Describe and represent transformations and symmetries of plane figures.
- 14) Make connections between analytic, numerical, and geometric methods to solve problems.

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### **4. Science Entry Competencies**

#### **A. Natural Sciences General Entry Competencies**

##### **I. Quantitative skills**

Students are more likely to succeed in a college science course if they enter with adequate preparation in mathematics. Students are strongly encouraged to meet the entry-level standards described for college math before enrolling in an introductory college-level science course.

##### **II. Scientific Inquiry**

- 1) Science understanding is developed through the use of scientific investigation, reasoning, and critical thinking.
  - a) Scientific inquiry requires the ability to gather and analyze information and ideas.
    - i) Apply sound library research skills (e.g., article searches, online databases).
    - ii) Evaluate a given source for its scientific credibility (e.g. web sites, product advertisements, use of personal testimony in place of scientific evidence, etc.).
    - iii) Read with comprehension and be able to summarize and draw conclusions from written material in basic science.
    - iv) Interpret data using various representations (e.g., graphs, tables, charts, and plots).
  - b) Scientific inquiry includes the ability to formulate a testable question and explanation.
    - i) Compose testable questions and hypotheses.
    - ii) Differentiate between a hypothesis and a scientific theory (e.g. a hypothesis is a tentative but testable explanation subject to experimentation; a scientific theory has been repeatedly confirmed through observation and experimentation).
    - iii) Design and conduct a valid experiment (formulate and clarify the method; identify the controls; collect, organize, display and interpret the data; make revisions of hypotheses, methods and explanations; present the results; and seek critiques from others).
    - iv) Recognize that it is not always possible, for practical or ethical reasons, to control some conditions (e.g., when sampling or testing humans, when observing animal behavior in nature).
    - v) Acknowledge there is no fixed procedure called “the scientific method,” but that some investigations involve systematic observations, models (e.g. astronomy), carefully collected and relevant evidence, and logical reasoning in developing hypotheses and other explanations.
  - c) Scientific inquiry includes the ability to select and utilize appropriate investigative methods and tools to gather and interpret relevant data.
    - i) Make qualitative and quantitative observations using the appropriate senses, tools and equipment to gather data (e.g., microscopes, thermometers, computers, balances, metric rulers, graduated cylinders).

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- ii) Measure length to the nearest millimeter, mass to the nearest gram, volume to the nearest milliliter, temperature to the nearest degree Celsius, time to the nearest second.
  - iii) Understand the metric system and perform simple conversions within the metric system and between the metric and US systems. Use and interpret values written in scientific notation (exponents).
  - iv) Judge whether measurements and computations of quantities are reasonable.
  - v) Calculate descriptive statistics (e.g. mean, median, mode, range, ratio, percentage).
  - vi) Depict data using various representations (e.g., graphs, tables, charts, and plots).
  - d) Scientific inquiry includes the evaluation of scientific principles and explanations (laws, theories, models) as well as the methods used to support them.
    - i) Analyze whether evidence (data) and scientific principles support proposed explanations.
    - ii) Communicate and defend a scientific argument.
- 2) A scientific theory is an explanation of some phenomenon of the natural world, based on a body of facts that have been repeatedly confirmed through observation and experiment.
- a) Scientific explanations of phenomena change over time as a result of new evidence (e.g., cell theory, theories of spontaneous generation, theories of extinction, evolutionary theory, genetic theory of inheritance).
    - i) Differentiate between scientific theories and laws. In science, a law is a description of a specific relationship among observable phenomena (e.g., the Gas Laws), but does not explain the observed relationship. A theory explains a set of laws and related phenomena (e.g. the theory of plate tectonics explains diverse observations regarding the distributions of volcanoes, earthquakes, and geological formations, as well as the relationships among organisms that inhabit different continents). Theories lead to new predictions and tests of those predictions.
    - ii) Explain why accurate recordkeeping, openness, and replication are essential for maintaining an investigator's credibility with other scientists and society.
    - iii) Recognize that acceptable validation of scientific theories includes reproduction of results and clearly reported methods and procedures that increase the opportunity for further research.
  - b) Knowledge is cumulative and learning requires retention of knowledge and application to further topics; knowledge gained in one science is applicable to other sciences.
- 3) Science and technology affect, and are affected by, society.
- a) Science and society interact to determine the direction of scientific and technological progress.
    - i) Understand that social and economic forces strongly influence which science and technology programs are pursued and supported with investment of resources and manpower.
    - ii) Recognize the role of science in both personal and public decision-making.

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- iii) Be able to evaluate scientific issues that impact your daily life.
- b) Science advances through the development and application of new technology and new ideas.
  - i) Realize that technological challenges may create a demand for new science technology.
  - ii) Understand that new technologies make it possible for scientists to extend research and advance knowledge.

### **B. Life Sciences Entry Competencies**

These competencies define the knowledge and skills needed for students to successfully enter and complete college-level work in biology. Sources used in preparation of this document include 1) Updated draft of Course Level Expectations in Science prepared by Missouri DESE 2) Quality in Undergraduate Education (Georgia State University Proposed Standards for Non-Majors Biology Course) 3) Natural Sciences, A Project of AAU and Pew Charitable Trusts 4) MoDEC entry-level skills recommendations in reading, writing and math and 5) ACT College Readiness Standards.

The purpose of high school biology is to help students develop a foundation in biology that focuses on major themes in the discipline, and to help them become scientifically literate citizens. For example, students need to be familiar with health-related issues, biotechnology and agriculture issues, environmental concerns, and the human impact on natural systems. Of equal importance is that students understand the nature of scientific endeavors. The recommendations in this document highlight major themes and concepts in the discipline. Towards this end we encourage emphasis be placed on why biological processes (e.g. mitosis, photosynthesis, respiration, etc.) are important and less emphasis be placed on the details of these processes. We also encourage a shift in the emphasis from cell and molecular biology to a more balanced approach that includes organismal, evolutionary and ecological biology.

#### **I. Properties and Principles of Matter and Energy**

- 1) Matter is composed of atoms that enter into chemical reactions to form molecules.
  - a) Cells carry out chemical transformations for the synthesis or breakdown of organic compounds.
    - i) Identify reactants and products in a chemical equation.
    - ii) Understand the importance of the water molecule and the carbon atom to living organisms.
    - iii) Identify the major organic compounds (proteins, nucleic acids, lipids, carbohydrates) that are found in living systems and identify their dietary sources.
  - b) Enzymes are chemicals that facilitate the breakdown and synthesis of molecules in living organisms.
- 2) Energy for most living organisms is derived ultimately from the sun.
  - a) Energy from the sun is converted to ATP within living organisms.
    - i) Understand that energy is stored or released in the breakdown and/or synthesis of organic compounds.

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- ii) Recognize that as energy is transformed from one form to another (e.g., metabolic pathways, food webs), the amount of usable energy decreases with each transformation.
- b) ATP is used by all organisms as a source of energy to do work in a cell.

### **II. Characteristics of Living Organisms**

- 1) Cells are the fundamental units of structure and function of all living things.
  - a) All cells share basic features (e.g., a plasma membrane).
    - i) Explain the characteristics that separate living cells from non-living matter (e.g. reproduction, metabolism).
    - ii) Recognize that all organisms are composed of cells, the fundamental units of structure and function; organisms may be unicellular or multicellular.
    - iii) Describe the structure of the plasma membrane and the function of the following cell components: plasma membrane, cell wall, cytoplasm, nucleus, chloroplast, mitochondrion, and ribosome.
    - iv) Predict the movement of molecules across the plasma membrane (i.e. diffusion, osmosis, active transport) as cells exchange materials with their environment or with other cells.
  - b) Different types of cells have different specializations.
    - i) State the similarities and differences between the cells of prokaryotes and eukaryotes, and plants and animals.
    - ii) Recognize that cells both increase in number and differentiate, becoming specialized in structure and function, during and after embryonic development.
- 2) Living organisms transform energy through the processes of photosynthesis and cellular respiration.
  - a) Photosynthesis and cellular respiration are complementary processes necessary for the survival of most organisms on Earth.
    - i) Compare and contrast the function of mitochondria and chloroplasts (know that mitochondria are responsible for converting energy from food to usable ATP and that chloroplasts harvest energy and carbon from the sun and air, respectively).
    - ii) Compare and contrast the products and reactants for the overall processes of photosynthesis and cellular respiration, stressing the importance of and the interrelationship between these processes (e.g., recycling of oxygen and carbon dioxide). Do not assess intermediate reactions (i.e. no light-dependent and light-independent reactions, Krebs cycle, etc). Focus on the beginning- and end-products of photosynthesis and cellular respiration.
  - b) Plants perform both photosynthesis and cellular respiration.
- 3) All living cells have genetic material (DNA) that carries hereditary information.
  - a) The organization of DNA into chromosomes is key to both replication of DNA and its distribution to new cells or organisms.
    - i) Differentiate between the terms genome, chromosome, DNA, and gene.
    - ii) Describe the chemical and structural properties of DNA (e.g., DNA is a double helix comprised of four different nucleotides).

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- iii) Explain how base-pairing rules allow cells to replicate DNA molecules.
  - iv) Recognize that an error in the DNA molecule (mutation) can be transferred during replication.
  - v) Identify possible external causes (e.g., heat, radiation, certain chemicals) and effects of DNA mutations (e.g., altered proteins which may affect chemical reactions and structural development).
  - b) Protein structure and function are coded by the DNA molecule.
    - i) Recognize that DNA codes for proteins, which are expressed as the heritable characteristics of an organism.
    - ii) Recognize that information flows from DNA to messenger RNA to a resulting protein. (Understanding this concept is more important than the details of transcription and translation.)
    - iii) Identify the diverse roles proteins play on the cellular level (enzymes, structure, communication, transport, etc.).
    - iv) Explain how most cells in an organism have the same DNA, genes and chromosomes, but are functionally different because they make different proteins (e.g., pancreatic islet cells make insulin while lymphocytes make antibody).
  - c) Biotechnology and genetic engineering (e.g., recombinant DNA technology) can be used to analyze or manipulate gene structure and function.
- 4) The reproductive process provides a genetic basis for the transfer of biological characteristics from one generation to the next.
- a) Reproduction can occur asexually or sexually.
    - i) Distinguish between asexual and sexual reproduction.
    - ii) Explain the importance of sexual reproduction in the generation of variation among individuals within a population.
  - b) Chromosomes carry hereditary information from one cell to daughter cells and from parent to offspring during reproduction.
    - i) Recognize that the reproduction of body cells (and asexual reproduction in single-celled organisms) occurs through the process of mitosis, which results in daughter cells that are genetically identical to the parent cell. Students do not need to name the stages of mitosis or meiosis.
    - ii) Recognize that through the process of meiosis, the number of chromosomes in gametes is reduced by half. (Emphasize the similarities and differences between mitosis and meiosis, rather than details of the stages involved.).
    - iii) Explain how fertilization restores the diploid number of chromosomes.
  - c) The pattern of inheritance for many traits can be predicted using the principles of Mendelian genetics.
    - i) Recognize that alleles are different versions of a single gene.
    - ii) Explain the chromosomal differences between human males and females (XY and XX, respectively).
    - iii) Predict the probability of the occurrence of specific traits, including sex-linked traits, in an offspring by using a monohybrid cross.
- 5) Structure is related to function in multicellular organisms.

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- a) The structure of multicellular organisms is best understood as a hierarchy of structural levels from cells, to tissues, to organs, to organ systems, that interact to maintain homeostasis.
  - i) Identify the major component parts and explain the function of the primary organ systems of humans, including respiratory, circulatory, reproductive, and digestive systems.
  - ii) Provide an example of how different components of the human body interact to maintain homeostasis.
- b) Structures in plants and animals support the function of energy transformation.
  - i) Relate the operation of body systems to the processes of cellular respiration, nutrient acquisition, and waste removal.
  - ii) Relate the major organs of plants (e.g. roots, stems, leaves) to their roles in photosynthesis.
- 6) A fundamental unity underlies the diversity of all living organisms.
  - a) Biological classifications are based on how organisms are related.
    - i) Recognize that the probability of relatedness can be determined by comparing DNA sequences.
    - ii) Explain how similarities used to group taxa might reflect evolutionary relationships (e.g., similarities in DNA and protein structures, morphology, etc.) with the focus on domains and kingdoms.
  - b) The classification of organisms is constantly being revised and extended as scientists gather more information.

### **III. Evolution and Ecology of Organisms**

- 1) The theory of evolution provides a fundamental framework for understanding the history and diversity of life on Earth and is the central unifying theme of biology.
  - a) Evidence for the nature and rates of evolution can be found in anatomical and molecular characteristics of organisms.
    - i) Explain the evidence that supports the theory of biological evolution (e.g., fossil records, homologous and vestigial structures, similarities among organisms in DNA/proteins and morphological traits).
    - ii) Identify how evolution is happening today (e.g., antibiotic resistant bacteria) and its impact on humans.
    - iii) Understand that evolution takes time. Evolution can happen in a few generations, but major change, such as speciation, often requires long periods of time.
  - b) Natural selection is one of the primary mechanisms of evolution.
    - i) Define evolution as a change in the proportions of alleles in a population. (Note: students do not need to know about Hardy-Weinberg equilibrium.)
    - ii) Explain that evolution is the outcome of natural selection: 1) Organisms pass their genetic traits to their offspring. 2) The offspring are not identical to each other, but carry genetic variation as a result of both mutations and new combinations of existing alleles. 3) Not all members of a generation will reproduce equivalently. 4) Because the genetic makeup of the next generation will be derived from those individuals that are able to pass on their alleles, the proportion of individuals with advantageous

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- characteristics will increase in the population. Note that while mutations occur randomly, the process of natural selection is not random.
- iii) Although natural selection can cause a new trait to become widespread, natural selection does not direct the mutations that cause the initial appearance of a trait in the population.
  - iv) Identify examples of adaptations that have resulted from variations favored by natural selection (e.g., long-eared jack rabbits, camouflaged insects) and describe how that variation provided individuals an advantage for survival.
  - v) Explain how environmental factors (e.g., habitat loss, climate change, pollution, introduction of nonnative species) can be agents of natural selection.
  - c) Extinction occurs as a result of both natural processes and human-induced changes in the environment.
    - i) Explain how genetic homogeneity may cause a population to be more susceptible to extinction (e.g., succumbing to a disease for which there is no natural resistance).
    - ii) Explain why species that are adapted to a particular environment may go extinct if the environment changes.
- 2) Organisms interact with one another and with their environment.
- a) Interactions among populations within a community affect the structure and balance of an ecosystem.
    - i) Understand that biologists view the natural world in a hierarchical organization from individuals, populations, communities and ecosystems.
    - ii) Define a species (e.g. the ability to mate and produce fertile offspring).
    - iii) Observe a local ecosystem (local pond, aquarium, etc.) and explain the nature of interactions between organisms in predator/prey relationships and different symbiotic relationships (i.e., mutualism, commensalism, parasitism).
    - iv) Understand the concept of the ecological niche of an organism (the interactions and interdependence of the organism with other organisms and the environment).
  - b) Living organisms have the capacity to produce populations of infinite size, but environments and resources are finite.
    - i) Identify and explain the limiting factors (biotic and abiotic) that may affect the carrying capacity of a population within an ecosystem.
    - ii) Explain how populations within an ecosystem may change in number and/or structure in response to changes in biotic and/or abiotic factors.
  - c) All organisms, including humans, and their activities cause changes in their environment that affect the ecosystem and the diversity of species within that ecosystem.
    - i) Explain how natural or human caused changes (biological, chemical and/or physical) in one ecosystem may affect other ecosystems due to natural mechanisms (e.g., global wind patterns, water cycle, ocean currents).
    - ii) Explain the impact (beneficial or harmful) that a natural or human caused environmental event (e.g., forest fire, flood, volcanic eruption, avalanche, acid rain, global warming, pollution, deforestation, introduction of an exotic species) may have on individuals, populations, species, communities and/or the global environment.
- 3) Matter recycles within and energy flows through the ecosystem.
- a) Matter (e.g., carbon, nitrogen, oxygen) is recycled within an ecosystem.

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- i) Recognize that living organisms play a critical role in recycling of matter.
- ii) Understand that human activities can alter the natural recycling of matter (e.g., global warming).
- b) As energy flows through the ecosystem, living organisms capture a portion of that energy and transform it to a form they can use.
  - i) Illustrate and describe the flow of energy within a food web and an energy pyramid.
  - ii) Predict how the use and flow of energy may be altered due to changes in a food web.

### **C. Physical Sciences Entry Competencies**

The physical sciences include Astronomy, Chemistry, Geology, and Physics. *College Knowledge: What It Really Takes for Students to Succeed and What We Can Do to Get Them Ready* was used as a resource for the competencies related to these courses. College Knowledge is written by David T. Conley and published by the Center for Education Policy Research in Eugene, Oregon. The competencies also embrace the National Science Standards as expressed in the K-12 standards as adopted by DESE.

A proficient level on Missouri high school science end-of-course exams is desired for all high school graduates; however, these competencies are specific for the introductory classes. The most important skill for success in physical science courses is mathematical proficiency. As mentioned in other places in this report, habits of mind are also very important to achieving that success. Further, students who complete high school chemistry and physics courses should be better prepared to be successful in college level physical science courses. While the competencies below are split into sections according to sub-disciplines within the physical sciences, there is large cross-over between these sub-disciplines such that competencies in one sub-discipline may apply to introductory courses in the others.

#### **I. Geology (Earth Science)**

Students should:

- 1) Be prepared to enter college algebra (see the Mathematics Entry Level Competencies).
- 2) Know that the earth is a body in space whose environmental system consists of the atmosphere, cryosphere, hydrosphere and biosphere; and that this system depends largely on the sun for light and heat.
- 3) Understand that the current environment (e.g., geography and climate) has changed dramatically in the past and will continue to do so.
- 4) Understand that relationships exist among the solid earth (geology and soil science), the water (hydrology and oceanography) and the atmosphere (meteorology and atmospherics).
- 5) Be aware of the major events in the geologic history of the Earth.

#### **II. Astronomy**

Students should:

- 1) Be prepared to enter college algebra (see the Mathematics Entry Level Competencies).
- 2) Be familiar with the nature of the solar system and the universe.

## **Appendix B: Entry Level Course Competencies**

- 3) Be familiar with the basic motions of bodies in space.
- 4) Have an appreciation of the immensity of the universe.

### **III. Chemistry**

Students should:

- 1) Be prepared to enter college algebra (see the Mathematics Entry Level Competencies).
- 2) Understand that atoms, molecules and ions have a set of physical and chemical properties that control their behaviors in a range of states.
- 3) Know that states of matter depend on molecular arrangement and freedom of motion.
- 4) Have a basic familiarity with the Periodic Table.
- 5) Know the structure of an atom.
- 6) Understand that molecules are composed of atoms in unique and consistent arrangements.
- 7) Know that substances react chemically in characteristic ways with other substances to form new substances (compounds) with different characteristics and properties.

### **IV. Physics**

Students should:

- 1) Be prepared to enter college algebra (see the Mathematics Entry Level Competencies).
- 2) Understand the relationship between energy, heat and temperature.
- 3) Understand conservation of mass and energy.
- 4) Understand the difference between position, velocity and acceleration.
- 5) Understand Newton's laws as a classical description of motion.
- 6) Know the characteristic properties of waves.
- 7) Understand every object exerts gravitational force on every other object.
- 8) Understand general concepts related to electrical and magnetic forces.

## **Appendix B: Entry Level Course Competencies**

### **5. Social Sciences Entry Competencies**

The Social Science Workgroup of the Missouri Department of Higher Education wish to present the following entry-level competencies in an effort to establish what they feel are the essential standards for successful entry into postsecondary social science coursework. The following competencies outline both general and discipline-specific knowledge. These standards are based upon the earlier work of the Association of American Universities and the PEW Charitable Trusts (*Social Sciences, A report for Standards for Success*, pp: 55-65. [www.s4s.org](http://www.s4s.org)).

#### **I. General Knowledge and Skills**

Successful students have a basic understanding of the social sciences (anthropology, history, economics, geography, political science, sociology). They:

- 1) Distinguish between the different characteristics that define the disciplines within the social sciences.
- 2) Are aware of current world events, issues, and problems and know how concepts and theories in the social sciences can be applied to understand them.
- 3) Perceive events and circumstances from the vantage point of others, including those in racial and cultural groups different from their own; from the other gender, from other ages; and from those who live under other political and economic systems.
- 4) Are able to identify and analyze problems appropriate to the social science discipline being studied.
- 5) Are able to distinguish between, read, and comprehend primary and secondary documents.

#### **II. History**

Successful students know significant periods and events in United States history. They understand important events, social movements and political processes that have shaped U.S. and World history, and are aware of the major historical figures that influenced history. These include but are not limited to:

- 1) The evolution and distinctive characteristics of major early Asian, African, and American pre-Columbian societies and cultures.
- 2) The connections among civilizations from earliest times, and the gradual growth of global interaction among the world's peoples, speeded and altered by changing means of transport and communication.
- 3) Comparative history of selected themes, to demonstrate commonalities and differences not only between European and other societies, but among European and non-European societies themselves.
- 4) Varying patterns of resistance to, or acceptance and adaptation of, industrialization and its accompanying effects, in representative European and non-European societies.
- 5) The adaptation of both indigenous and foreign political ideas, and practices in various societies. Borrowers of other's political ideas, exporters of political ideas.

## **Appendix B: Entry Level Course Competencies**

- 6) The interplay of geography and local culture in the responses of major societies to outside forces of all kinds.
- 7) The evolution of American political democracy, its ideas, institutions, and practices from colonial days to the present; the Revolution, the Constitution, slavery, the Civil War, emancipation, and civil rights.
- 8) The development of the American economy; geographic and other forces at work; the role of the frontier and agriculture; the impact of technological sources and urbanization on land and resources, on society, politics, and culture. The role and emancipation of American labor.
- 9) The gathering of people and cultures from many places, and the several religious traditions, that have contributed to the American heritage and to contemporary American society.
- 10) The changing role of the United States in the outside world; relations between domestic affairs and foreign policy; American interactions with other nations and regions, historically and in recent times. The United States as a colonial power and in two world wars. The Cold War and global economic relations.
- 11) The distinctively American tensions between liberty and equality, liberty and order, region and nation, individualism and the common welfare, and between cultural diversity and civic unity.
- 12) The major successes and failures of the United States, in crises at home and abroad. What has “worked” and what has not, and why.

### **III. Political Science (Civics)**

- 1) Successful students have a basic understanding of types of governments. They:
  - a) Understand the nature and source of various types of political authority (e.g., the differences between democracy and oligarchy).
- 2) Successful students have a basic understanding of the U.S. political system and its history. They:
  - a) Know basic facts about the U.S. political system and constitutional government (e.g., federalism; checks and balances; and legislative, executive and judiciary branches of power).
  - b) Understand the content and context of documents that established the U.S., especially The Declaration of Independence and the U.S. Constitution.
  - c) Understand the content and context of documents important for the protection of individual rights in the U.S., especially the U.S. Constitution and the Bill of Rights.
  - d) Know the methods citizens can use to participate in the political process at local, state and national levels, and how political participation can influence public policy.

### **IV. Geography**

Below are entry-level competencies in geography. These competencies encompass general concepts in Geography, Physical Geography and Human Geography. It is not our expectation that students would be fully conversant in these concepts when entering college, but that they

## **Appendix B: Entry Level Course Competencies**

would have been exposed to many of them. Traditionally, place name identification has been conceived of as the main focus of geography, but much more important are the major geographical concepts and cultural understanding of the diversity of the places in the world. Geographical approaches link many different branches of the social sciences, as well as the physical sciences. As such students who have exposure to these concepts will be more likely to succeed in not only college-level geography courses, but they will be in a stronger position to succeed in other courses, such as: introduction to physical science, surveys of American and world history, introduction to sociology and anthropology courses, and beginning government courses. Students meeting entry-level expectations in geography will be able to:

- 1) Use maps to determine and define major geographical units, such as: regions, continents, countries, and major cities.
- 2) Identify and interpret different types of maps, such as: topographic (raised relief and contour), cartograms, proportional symbol, and choropleth maps
- 3) Identify and define places by understanding ethnicity; language and language systems; and patterns of religion
- 4) Define and distinguish between concepts of relative distance and absolute distance, relative direction and absolute direction, relative location and absolute location
- 5) Understand fundamental population models, such as the demographic transition model, and associated terminology, including but not limited to, total fertility rate, rate of natural increase, etc.
- 6) Describe different patterns of migration, the different types of migration, and the causes of migration
- 7) Read and interpret data in atlases, e.g. percentage of population who are farmers, population density, percentage of population that live in urban areas
- 8) Identify the continents of the world and their major topographic qualities, i.e. mountainous, high plateau, etc and demonstrate an understanding of how these qualities influence human settlement patterns
- 9) Distinguish between weather and climate and demonstrate an understanding of how climate influences human settlement patterns
- 10) Identify areas of the world by their dominant vegetation characteristics, i.e. savanna, tropics and demonstrate an understanding of how this influences human settlement patterns
- 11) Identify major bodies of water, i.e. oceans, seas, and major rivers and distinguish between fresh and salt water and demonstrate an understanding of how proximity to fresh water continues to influence human settlement patterns.

## **Appendix C: Draft Cross-Disciplinary Competencies**

Included Draft Cross-Disciplinary Competencies:

1. Habits of Mind..... 43
2. Reading and Writing..... 47
3. Technology and Information Literacy..... 49

## **Appendix C: Draft Cross-Disciplinary Competencies**

### **1. Cross-Disciplinary Entry Level Standards for Habits of Mind**

#### **I. Intellectual curiosity**

- 1) Engage in intellectual inquiry and dialogue.
  - a) Identify what is known, not known, and what one wants to know in a problem.
  - b) Conduct investigations and observations.
  - c) Cite examples or illustrations in which a clear-cut answer cannot be reached.
- 2) Revise personal views when valid evidence.
  - a) Articulate own point of view and provide valid evidence to support findings.
  - b) Demonstrate willingness to take intellectual risks by investigating novel, controversial, or unpopular opinions or conclusions.
  - c) Examine alternative points of view, taking different roles to defend, oppose, and remain neutral on issues.
  - d) Recognize conflicting information or unexplained phenomena.

#### **II. Reasoning**

- 1) Consider arguments and conclusions of self and others.
  - a) Know and apply logic to analyze patterns and descriptions and to evaluate conclusions.
  - b) Cite valid examples or illustrations that support the conclusions.
  - c) Question whether the claims and conclusions of self and others are supported by evidence.
  - d) Identify counter examples to disprove a conclusion.
- 2) Construct reasoned arguments to explain phenomena, validate conjectures, or support positions.
  - a) Participate in a debate that is based on facts and has a logical structure.
  - b) Construct a visual presentation, including hypothesis, data, results, and conclusion.
  - c) Write a paper that addresses counter-arguments to advocated positions.
  - d) Recognize and apply techniques of statistical or probabilistic analysis to judge reliability of information.
  - e) Organize an argument separating fact from opinion.
- 3) Gather empirical evidence to support or modify claims based on the results of an inquiry.
  - a) Use different kinds of data (e.g., case studies, statistics, surveys, documents) to support an argument.
  - b) Evaluate evidence in terms of quality and quantity.
  - c) Describe limitations of data collection methods.
  - d) Refine claims and adjusts a position in response to inquiry.
  - e) Review and check strategies and calculations, using alternative approaches when possible.

#### **III. Problem Solving**

- 1) Analyze a situation to identify a problem to be solved.

## **Appendix C: Draft Cross-Disciplinary Competencies**

- a) Represent and/or restate the problem in one or more ways (e.g., graph, table, equation), showing recognition of important details and significant parameters.
  - b) Break complex problems into component parts that can be analyzed and solved separately.
  - c) Apply previously learned knowledge to new situations.
  - d) Analyze a media report, identify any misuse of statistics, and suggest ways to more accurately depict this information.
- 2) Develop and apply multiple strategies to solving a problem.
    - a) Use a range of standard methods, devices, techniques, and strategies to gather and analyze information.
    - b) Use knowledge gained from other subject areas to solve a given problem.
  - 3) Collect evidence and data systematically and directly relate to solving a problem.
    - a) Use general and specialized reference works and databases to locate sources.
    - b) Collect evidence and data directly related to solving the problem and discard irrelevant information.
    - c) Produce charts, graphs, and diagrams accurately, including scale, labeling, units, and organization.
    - d) Present the collected data visually, describe the data collection procedure, and defend choosing that procedure over other possibilities.

## **IV. Academic behaviors**

- 1) Accept personal responsibility for education as an active learner (e.g.).
  - a) Attends class regularly and is on time.
  - b) Notifies teacher prior to absences when possible and uses legitimate and reasonable excuses.
  - c) Responsible for all assignments on-time and what is covered in class – both attended and missed classes.
  - d) Attentive in class and participates in class discussion.
  - e) Completes all assignments on time and in appropriate format, clean and neat.
  - f) Prepares for texts and exams.
  - g) Demonstrates positive affirmation about self learning.
- 2) Self-monitor learning needs and seek assistance when needed.
  - a) Ask questions to check for understanding or to clarify information.
  - b) Use a systematic method for recording, storing, and organizing materials and resources; avoid haphazard or messy accumulation of information.
- 3) Use study habits necessary to manage academic pursuits and requirements.
  - a) Manage time effectively to complete tasks on time.
  - b) Demonstrate accurate note-taking.
  - c) Use the appropriate level of detail necessary to complete an assigned task.
  - d) Balance academic and non-academic activities to successfully participate in both.

## **Appendix C: Draft Cross-Disciplinary Competencies**

- 4) Strive for accuracy and precision.
  - a) Collect and report experimental data carefully and correctly.
  - b) Produce charts, graphs, and diagrams accurately, including scale, labeling, units, and organization.
  - c) Eliminate irrelevant information from an assignment.
- 5) Persevere to complete and master tasks.
  - a) Persevere until a task is completed by working even when faced with uncertainty or open-ended assignments.
  - b) Seek assistance when needed to complete the assignment.
  - c) Recognize when a task is completed.

### **V. Work habits**

- 1) Work independently or collaboratively as appropriate for the given situation.
  - a) Plan a project, establish its parameters, and complete it with minimal supervision, seeking assistance accordingly.
  - b) Follow directions or procedures independently.
  - c) Complete assignments outside the classroom setting in a timely manner.
- 2) Work as a contributing team member.
  - a) Work collaboratively with students from various cultural and ethnic backgrounds.
  - b) Distinguish between situations where collaborative work is appropriate and where it is not.
  - c) Work in small groups to investigate a problem or conduct an experiment.

### **VI. Academic and Personal Integrity**

- 1) Attribute ideas and information to source materials and people.
  - a) Document the work of others, giving credit where credit is due and never claim credit for work that is not one's own.
  - b) Use standard bibliographic and reference citation formats, choosing the style appropriate to the subject and the audience.
  - c) Define plagiarism and articulate the consequences of academic dishonesty.
- 2) Evaluate sources for quality of content, validity, credibility, and relevance.
  - a) Verify validity of a source within a submitted work.
  - b) Compare and contrast coverage of a single topic from multiple media sources.
- 3) Include the ideas of others, and the complexities of the debate, issue, or problem.
  - a) Present multiple perspectives of an issue.
  - b) Represent accurately the data, conclusions, or opinions of others.
- 4) Attend and adhere to ethical codes of instructional and academic conduct.
  - a) Follow copyright laws and restrictions.

## **Appendix C: Draft Cross-Disciplinary Competencies**

- b) Use technology responsibility (e.g., avoiding malice, misrepresentation, or misleading use of information).
  - c) Follow institutional codes of academic integrity, e.g., plagiarism.
- 5) Attend and adhere to ethical codes of personal and social conduct.
- a) Bases behavior upon ethical principles.
  - b) Exhibit non-discriminatory behavior.
  - c) Exercises rights and responsibilities of membership in communities of place and interest.

## **Appendix C: Draft Cross-Disciplinary Competencies**

### **2. Entry Level Skills for College Preparedness in Reading, Writing, & Oral Communication**

#### **I. Reading Across the Curriculum**

- 1) Use effective pre-reading strategies
  - a) Use the title, knowledge of the author, and place of publication to make predictions about a text.
  - b) Use a table of contents and/or index to preview a text and understand its design.
  - c) Scan headline sections or other division markers, graphics, or sidebars to form an overview of a text.
  - d) Identify the intended purpose and audience of a text based on the title, preface, and other features of a text.
  - e) Adapt reading strategies according to structure of texts (e.g. forms & genres).
- 2) Use a variety of strategies to understand the meanings of new words
  - a) Use context clues, including definitions, examples, comparison, contrast,
  - b) Consult online and print references effectively (e.g. dictionary, thesaurus).
  - c) Identify and define key terminology, notation, and symbols from technical and/or scientific documents.
- 3) Identify & analyze textual information critically
  - a) Summarize the major points in a text and use graphic organizers to organize ideas and concepts in a visual manner.
  - b) Analyze connections between major and minor ideas.
  - c) Recognize, interpret, and draw inferences from graphic and other non-verbal materials (e.g., graphs, maps).
  - d) Identify faulty premises in an argument.
  - e) Identify stated and implied assumptions.
  - f) Identify conclusions unsupported by sufficient evidence in informational texts.
  - g) Use inductive and deductive reasoning.
  - h) Apply the material learned from reading to solve problems.
- 4) Connect reading to historical and current events and personal interest.

#### **II. Writing Across the Curriculum**

- 1) Understand and use a writing process.
  - a) Have flexible strategies for generating, revising, editing, and proofreading.
  - b) Understand writing as an open, flexible process that permits a writer to use later invention and rethinking to revise work.
- 2) Compose sound sentences
  - a) Use a variety of sentence structures correctly.
  - b) Produce sentences free of major sentence-level errors.
  - c) Communicate with few errors in grammar, usage and mechanics.

## **Appendix C: Draft Cross-Disciplinary Competencies**

- 3) Compose sound paragraphs
  - a) Write focused topic sentences.
  - b) Use descriptive details, examples, and facts to develop the paragraph's main idea.
  - c) Use effective patterns of organization and development.
  - d) Use transitional devices within paragraphs to achieve coherence and focus.
- 4) Produce sound discourse
  - a) Use basic essay structure, including an introduction, body, and conclusion.
  - b) Construct thesis statements.
  - c) Organize ideas logically.
  - d) Develop an essay's main idea with adequate and specific supporting detail.
  - e) Use transitional devices within essays to achieve coherence, flow, and focus.
  - f) Maintain appropriate tone and vocabulary for target audience.
- 5) Conduct Research
  - a) Distinguish between primary and secondary research.
  - b) Generate questions and areas to pursue.
  - c) Acknowledge source material and be able to distinguish it from personal ideas.
  - d) Locate and retrieve relevant information using traditional and contemporary technologies.
  - e) Evaluate reliability of information and sources.
  - f) Record relevant information.
  - g) Document sources of information, using recognized documentation format, to include textual as well as bibliographical references.

### **III. Oral Communication Across the Curriculum**

- a) Recognize the importance of effective speaking and listening habits.
- b) Organize and deliver appropriate oral presentations for specific disciplines.
- c) Use conventions of Standard English with few errors.
- d) Use critical and constructive listening skills.
- e) Distinguish among a variety of oral and written communication situations.
- f) Demonstrate methods of creative communication through effective audience awareness and adaptation.
- g) Demonstrate the use of audio/visual aids.

## **Appendix C: Draft Cross-Disciplinary Competencies**

### **3. Cross-Disciplinary Entry Level Skills for Technology and Information Literacy**

#### **1) Internet Navigation**

Students will demonstrate:

- a) Knowledge of content on the Internet by types such as commercial, government, research, social interaction, history, opinion, etc.
- b) Skill in using Web browsers such as Internet Explorer, Firefox, and others.
- c) Effectiveness in using search engines to locate specific information.
- d) Proficiency in downloading files such as print content, still and video images, music, software applications and utilities, etc.

#### **2) Software Application**

Students will demonstrate:

- a) Functionality with Graphical User Interface (GUI) navigation via buttons, clicking, drag and drop, cut/copy/paste, saving one's work, login/logout, etc.
- b) Proficiency with word processing applications such as Microsoft Word.
- c) Ability to create, to send, and reply to e-mail and e-mail attachments.
- d) Basic skills in creating presentations via applications such as Microsoft PowerPoint.
- e) Competent usage of content management software (Blackboard, Moodle, et.al).

#### **3) Hardware Operation**

Students will demonstrate:

- a) The ability to use USB flash drives, optical disc media, and other options for data storage and retrieval.
- b) Knowledge of printers and other hardware devices as applicable.

#### **4) Techniques for Research**

Students will demonstrate:

- a) Skills in using library databases and catalogs.
- b) Critical evaluation of web resources for credibility, reliability, and accuracy.
- c) Proper documentation of electronic source material.

#### **5) IT ethics and socially responsible use of IT-related resources**

Students will identify or explain:

- a) Basics of copyright law and fair use concepts.
- b) Ethical aspects of file uploading, downloading, and file sharing.
- c) General understanding of software licensing practices.
- d) Distinction between proprietary and open-source (freeware) approaches to software distribution.
- e) Social issues regarding the “digital divide” as it applies to access to technology.
- f) How this division affects economic and workforce issues relating to society and technology.

## **Appendix D: Draft METS Entry Competencies**

Included METS Entry Competencies:

1. Engineering..... 51
2. Information and Engineering Technology... 56

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## Appendix D: Draft METS Entry Competencies

### 1. Draft Engineering Entry Competencies

Note: All calculations should be performed without the use of technology (i.e., calculator). Some examples of skills are provided in parentheses.

#### I. Algebra and Real Numbers

- 1) Use symbols and operators to represent ideas and objects and the relationships existing between them.
- 2) Understand the relationship between measures of the physical world. (Velocity, distance and time: On a 40-mile car trip to Middletown, NY, you drive the first twenty miles at 40 mph and the last twenty miles at 60 mph. What is your average speed during the trip?)
- 3) Know and apply the following algebraic properties of the real number system: identity, associative, commutative, inverse, and distributive.
- 4) Express numbers using scientific notation. (Express 0.004312 in scientific notation.)
- 5) Write a number as the product of factors. (Write 42 as the product of prime factors.)

#### II. Radicals and Exponents

- 1) Convert between radical and rational exponent form. (Transform  $\frac{1}{\sqrt{x+2}}$  to the rational exponent form  $(x+2)^{-\frac{1}{2}}$ .)
- 2) Manipulate algebraic expressions that contain integer and rational exponents. (Simplify  $4^{-\frac{3}{2}} \bullet 27^{-\frac{2}{3}}$ .)

#### III. Algebraic Expressions

- 1) Add, subtract, multiply, and divide algebraic expressions. (Find the remainder when  $x^3 - 7x^2 + 9x$  is divided by  $x - 2$ .)
- 2) Simplify algebraic expressions. (Expand and simplify  $(x - 3)(x - 2)(x - 1)$ .)

#### IV. Linear Equations, Inequalities and Absolute Values

- 1) Understand the meaning of solutions to linear and rational equations and be able to solve such equations whenever appropriate.
- 2) Determine the equation of a line. (Find the equation of a straight line passing through the points  $(2, 1)$  and  $(5, 4)$ .)
- 3) Determine the equation of a line that is parallel or perpendicular to a given line. (Find the equation of a line parallel to the line  $2y - 3x = 7$  and passing through the point  $(1, 2)$ .)
- 4) Solve 2 simultaneous linear equations by graphing and by substitution. (Use a graph to estimate the point of intersection of the lines  $2x + 3y = 7$  and  $-x + y = 4$ . Verify your result using back substitution.)

## Appendix D: Draft METS Entry Competencies

- 5) Solve linear equations and inequalities [graphically and algebraically]. (Solve  $5(3 - x) > 2(x - 2x)$  for  $x$ .)
- 6) Understand the meaning of solutions to linear and absolute value inequalities. Solve linear equations and inequalities with absolute values. (Solve  $|x - 4| \geq 3$  for  $x$ .)
- 7) \*Understand the meaning of solutions to linear systems of equations and be able to use effective ways to find and express possible solutions.
- 8) \*Understand the concepts of matrices and their inverses (if exist), matrix operations, determinants, and be able to perform required computations. Understand how matrices are used to model and solve system of linear equations and be able to perform required appropriate computations.

\* Recommended Topics

### V. Polynomials, Roots of Polynomials, and Rational Inequalities

- 1) Understand the properties and graphs of polynomial functions.
- 2) Understand the meaning of zeros of polynomial functions and their connection to the graphs of these functions.
- 3) Solve for the roots of a polynomial by factoring. (Find the roots of  $x^2 - 5x + 6 = 0$ .)
- 4) Understand the meaning of the Remainder Theorem and its application to evaluating polynomial functions.
- 5) Understand the meaning of the Factor Theorem and its application to solving polynomial equations.
- 6) Understand the meaning of solutions to polynomial and rational inequalities and be able to solve such inequalities whenever appropriate.
- 7) Solve simple polynomial inequalities. (Solve  $x^2 + 3x + 6 > x - 4$  for  $x$ .)
- 8) Solve simple rational inequalities. (Solve  $\frac{x-3}{x+1} < 2$  for  $x$ .)
- 9) Understand the importance of the Fundamental Theorem of Algebra, its application to polynomial equations, and its connection to complex numbers.

### VI. Functions, Graphs and Graphing

- 1) Identify the independent and dependent variables of a function.
- 2) Evaluate a function at a point. (Given  $f(x) = 3x^2 - 2x + 4$ , find  $f(2a)$ .)
- 3) Determine the domain and range of a real valued function. (Find the domain and range of the real valued function  $g(x) = \frac{1}{x^2 - 2}$ .)
- 4) Understand the concept of combining functions and be able to perform these operations and recognize the resulted functions and their properties.
- 5) Evaluate composite functions. (Given  $h(r) = 3r^2$  and  $g(s) = 2s$ , find  $h(a + 2) - g(2a)$ .)
- 6) Understand the concept of piecewise-defined functions and be able to translate this knowledge to their properties and graphs.

## Appendix D: Draft METS Entry Competencies

- 7) Graph equations and inequalities. (Sketch a graph of the function  $f(x) = 3x^2 - 2x + 7$  for  $1 < x < 5$ .)
- 8) Understand the concept of transformation (e.g., shifting, reflecting, stretching, shrinking) of functions and be able to recognize and apply such knowledge when graphing functions.
- 9) Transform the graph of a known function. (From the graph of  $f(x)$ , graph  $g(x) = 2f(x) - 3$ .)
- 10) Understand the invertibility of functions and the relationship between functions inverse to each other, and be able to determine inverse functions when appropriate.
- 11) Understand the properties and graphs of rational functions and be able to generate appropriate information, including axes, intercepts, asymptotes, and roots.
- 12) Know the general characteristics and shapes of the graphs of polynomial, logarithm, exponential and trigonometric functions.
- 13) Understand the properties and graphs of parabolas, ellipses, and/or hyperbolas and be able to perform basic related algebraic/graphing operations.

### VII. Equations of Quadratic Type and Complex Numbers

- 1) Understand the concept of complex numbers and be able to perform operations involving them.
- 2) Calculate the sum, difference, product, and quotient of complex numbers and express the result in standard form.
- 3) Understand the meaning of solutions to quadratics equations and be able to solve such equations
- 4) Solve for real and complex roots using the quadratic formula. (Find the roots of  $3x^2 + 2x = -1$ .)
- 5) Solve a system of quadratic equations in 2 variables by substitution. (Solve the system  $y = 3 - x^2$  and  $y = 4 + 2x^2 - 2x$ .)
- 6) Understand the relationship between quadratic functions and parabolas, and able to connect such knowledge to quadratics equations.

### VIII. Logarithmic and Exponential Functions

- 1) Understand the meaning of solutions to exponential and logarithmic equations and be able to apply the inverse relationship between exponentials and logarithms to equations involving them whenever appropriate.
- 2) Apply the properties of logarithms and their relationship to exponentials. Be able to perform operations on logarithms. [ $y = \log_a x$ ,  $a > 0$ ,  $a \neq 1$ , is the inverse of the function  $y = a^x$ ;  $\log_a x \Leftrightarrow a^y = x$ ]. (Evaluate  $\log_3 27$ .)
- 3) Know the properties of the logarithmic and exponential functions and use them to simplify logarithmic expressions. (Express as a single logarithm:  $0.5 \log_{10} x - \log_{10} y$ .)
- 4) Know how to solve simple logarithmic and exponential equations. (Solve the equation  $3^{x+4} = 4$  for  $x$ .)
- 5) Understand the properties and graphs of logarithmic and exponential functions and be able to evaluate and graph such functions.

## Appendix D: Draft METS Entry Competencies

- 6) Understand the meaning of exponential growth and decay and apply the knowledge of exponential and logarithmic functions model two applications.

### IX. Analytic Geometry

- 1) Know and apply the distance formula between 2 points. (Find the distance between the two points A(1, 2) and B(-5, -3).)
- 2) Understand the geometric concepts of angle (e.g. initial side, terminal side, coterminal angles, degree, radian, central angle, circular arc length, circular sector area, and reference angle) and be able to apply appropriate properties.
- 3) Know and apply the circumference and area formulas for circles, triangles, and rectangles. (If you double the radius of a circle, what happens to its circumference?)
- 4) Know and apply the surface and volume formulas for cylinders, spheres and rectangular solids.
- 5) Know the relationship between similar triangles. (A rectangle with base  $x$  and height 5 is inscribed in an isosceles triangle with base 10 and height 20. Determine  $x$ .)
- 6) Know and apply the Pythagorean Theorem to simple geometric problems. (Given a rectangle that is 4 ft by 7 ft determine the length of the diagonal.)

### X. Use of Mathematics to Solve Application from Various Fields

- 1) Apply the acquired understanding and knowledge of functions to model appropriate real-world situations and draw mathematical conclusions.
- 2) Understand the underlining principle of variation and how it is used to model many applications.
- 3) \* Understand the meaning of solutions to systems of nonlinear equations and be able to use effective ways to find and express possible solutions.
- 4) Understand the meaning of compound interest and apply the knowledge of exponential functions to model this application.
- 5) \* Be able to use trigonometry to model and solve basic applied problems.

*\*Recommended Topics*

### XI. Trigonometric Functions & Their Inverses

- 1) Define each of the 6 trigonometric functions ( $\sin(\theta)$ ,  $\cos(\theta)$ ,  $\tan(\theta)$ ,  $\cot(\theta)$ ,  $\sec(\theta)$ , and  $\csc(\theta)$ ) in terms of the sides of a right triangle. ( $\cos(\theta) = \frac{x}{r}$  where  $x$  is the adjacent side and  $r$  is the hypotenuse.)
- 2) Define each of the 6 trigonometric functions in terms of  $\sin(\theta)$  and  $\cos(\theta)$ . ( $\tan(\theta) = \frac{\sin(\theta)}{\cos(\theta)}$ .)
- 3) Understand the concepts of the six trigonometric functions, both in terms of a unit circle and a right triangle, and be able to apply such knowledge.
- 4) Know the domain and ranges for the sine, cosine, and tangent functions.
- 5) Convert angle measures between degrees and radians. (Write 120 degrees as a radian measure.)

## **Appendix D: Draft METS Entry Competencies**

- 6) Memorize and use the 30/60/90 and 45/45/90 degree reference triangles.
- 7) Understand the graphs of the six trigonometric functions and be able to recognize and apply such knowledge (including incorporation of appropriate transformations: shifting, reflecting, stretching, and shrinking).

### **XII. Trigonometric Identities and Equations**

- 1) Understand the general nature of proving trigonometric identities and be able to perform such task appropriately.
- 2) Know and apply the trigonometric identity  $\sin^2(\theta) + \cos^2(\theta) = 1$ . (Simplify the expression  $2\cos^2(\theta) + \sin^2(\theta) - 1$ .)
- 3) Understand the general nature of trigonometric equations and be able to solve such equations whenever appropriate.
- 4) Be familiar with useful formulas (e.g. addition and subtraction, double-angle, half-angle, product-to sum, sum-to-product, law of sines, law of cosines, and Heron's) and able to use them appropriately.
- 5) Understand the concepts and graphs of inverse trigonometric functions and their related properties, and be able to perform appropriate operations.

### **XIII. Recommended Topics in Trigonometry**

- 1) Understand the trigonometric form and its geometric interpretation for complex numbers, and be able to recognize and perform basic conversions.
- 2) Understand the multiplication and division of complex numbers in trigonometric form and their respective geometric interpretation.
- 3) Understand De Moivre's Theorem and its geometric interpretation, and be able to apply the concept to find roots of complex numbers.
- 4) Understand the basic concepts and operations of two-dimensional vectors, their respective geometric interpretation, and the trigonometric aspect of the inner (dot) product.
- 5) Geometry of complex numbers.

## Appendix D: Draft METS Entry Competencies

### **2. Engineering & Information Technology Entry-Level Competencies**

*With thanks to ISTE's National Educational Technology Standards for Students project and the Missouri Developmental Education Consortium*

#### I. Math

- 1) Use the x/y/z coordinate system to depict results of mathematical operations.
- 2) Understand and apply the metric system.
- 3) Demonstrate proficiency in defining and referencing ratios.
- 4) Display skill in working with fractions.
- 5) Utilize associative, commutative, and distributive properties.
- 6) Simplify expressions using the order of operations.
- 7) Distinguish between elements of the sets of real numbers.
- 8) Distinguish between expressions, equations by type, and inequalities.
- 9) Solve expressions, equations by type, and inequalities.
- 10) Use graphs and number lines to depict results of equations and inequalities.
- 11) Identify, solve, and label systems of equations.
- 12) Use scientific notation to simplify exponential expressions.
- 13) Employ polynomial operations and terminology correctly.
- 14) Solve quadratic equations by factoring and quadratic methods.
- 15) Perform standard operations with rational expressions.
- 16) Perform standard operations with terms containing radicals.
- 17) Perform graphing skills to depict results of equations and inequalities.
- 18) Use a calculator to perform basic mathematical operations.

#### II. Computer Literacy

- 1) Applications—demonstrate a standard proficiency in each of the following:
  - a) Word processing.
  - b) Presentation.
  - c) Spreadsheet.
  - d) Web browser.
  - e) E-mail client.
  - f) File transfer client.
- 2) Computer Savvy
  - a) Recognize basic hardware by concept and by usage:
    - i) Desktop computer—PC or Macintosh.
    - ii) Printer—inkjet, laser, and dot-matrix.
    - iii) Scanner—by type and quality.
    - iv) Digital camera—still-shot and motion video.
    - v) MP3 player—by make and quality.
  - b) Apply existing knowledge when learning new technologies.
  - c) Develop or learn basic troubleshooting skills.
  - d) Identify basic networking concepts for local- and wide-area networks.
  - e) Demonstrate basics for computer security and safe computer use.
- 3) Operating Systems Skills
  - a) Use operating system features and functions.

## **Appendix D: Draft METS Entry Competencies**

- b) Manage the user interface.
- c) Understand file formats.
- d) Demonstrate skill with file management.
- e) Understand interaction between operating systems and applications.

### **III. Communication Skills**

- 1) Demonstrate comprehension skills in written, verbal, and graphic information structures.
- 2) Interact / collaborate / publish with peers, experts, and others through varied digital environments and media types.
- 3) Communicate ideas via variety of media and formats.
- 4) Contribute to project teams to produce and deliver original works or to solve problems.
- 5) Develop and demonstrate global cultural understanding and awareness by communicating with learners from non-native cultures.
- 6) Identify and explain how computers affect interaction in local society and between cultures.

### **IV. Professionalism**

- 1) Positive work ethic.
  - a) Provide proof of punctual and reliable conduct.
  - b) Employ a positive mental attitude.
  - c) Demonstrate honesty in all actions.
- 2) Personal and business ethics.
  - a) Embrace and exhibit the concept of personal honesty
  - b) Understand and follow legal standards applicable to IT.
  - c) Understand and follow IT business accountability standards.
- 3) Digital citizenship.
  - a) Understand human, cultural, and societal issues related to technology.
  - b) Advocate and practice safe, legal, and responsible information and technology use.
  - c) Exhibit a positive attitude for collaboration, learning, and productivity via technology.
  - d) Demonstrate personal responsibility for lifelong learning.

### **V. Research and information gathering skills**

- 1) Search engine usage.
  - a) Employ effective querying skills.
  - b) Demonstrate how to search within results.
  - c) Show how to store and consult search results.
- 2) Other digital tools.
  - a) Plan strategies to guide inquiry.
  - b) Gather, organize, analyze, synthesize, and use information from media sources.
  - c) Consider and select appropriate methods for information delivery

## **Appendix E: Exit-Level Course Competencies**

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## **Appendix E: Exit-Level Course Competencies**

### **1. Introduction to Philosophy**

1. Students will identify the major areas of philosophy (e.g., metaphysics, epistemology, ethics and political philosophy, and logic) and explain and analyze (perhaps with reference to historical figures) some of the major philosophical problems in several of these areas.
2. Students will identify and evaluate arguments in general and on philosophical topics.
3. Students will develop and defend a thesis on philosophical topics.
4. Students will critically examine their own views, to try to understand those of others, and to appreciate that on complex matters reasonable people can disagree.

## **Appendix E: Exit-Level Course Competencies**

### **2. Introduction to Theatre**

Students exiting a college level Introduction to Theatre class should be able to meet the following objectives:

In the case of the first objective, students will meet the requirement through actual physical participation in the making of a theatrical production. For the rest of the objectives students will demonstrate the requirements through the use of clear, correct, and properly cited writing. Students will:

- 1) Participate (in some way) in the production and/or presentation of a play.
- 2) Show in writing a familiarity with several playwrights' work.
- 3) Restate the through-line or theme of a play in writing.
- 4) Describe how you would complete one of the tasks in presenting live theatre.
- 5) Show through testing or writing a familiarity with the major movements in the history of theatre.
- 6) Compose and write a beginning, personal theatre aesthetic with which to evaluate a performance.

## **Appendix E: Exit-Level Course Competencies**

### **3. Freshman Composition Sequence**

The following competencies are the writing, thinking, communication, and expressive skills identified and recommended by a group of high school teachers, community, and four-year college English instructors. Upon successfully completing the required freshman composition course or sequence of courses, students should be able to do the following:

- 1) Demonstrate critical and analytical thinking for reading, writing, and speaking.
  - a) Participate in active reading and discussion of a variety of texts.
  - b) Incorporate ideas and information from readings into own writing.
  - c) Identify purpose, main idea, and supporting evidence.
  - d) Distinguish between fact and opinion and recognize textual biases.
  - e) Distinguish between general and specific information.
  - f) Summarize and paraphrase information.
  - g) Analyze and evaluate their own and others' speaking and writing.
  - h) Communicate effectively in groups by listening, reflecting, and responding appropriately.
  - i) Formulate diagnostic questions for resolving issues and identify possible solutions.
  - j) Show an awareness of the different modes of comprehension, as well as expression, required for effective oral communication, as opposed to written.
- 2) Compose sound and effective sentences.
  - a) Use a variety of sentence structures correctly.
  - b) Understand and employ subordination and coordination to express ideas.
  - c) Avoid major sentence-level errors such as fragments, comma splices, fused sentences, etc.
  - d) Communicate with few errors in grammar, usage, diction, and mechanics.
- 3) Compose unified, coherent, and developed paragraphs.
  - a) Write focused topic sentences.
  - b) Maintain focus and unity of paragraph.
  - c) Use details, examples, and facts to develop the paragraph's main idea.
  - d) Select and use appropriate patterns of organization for subject audience, and purpose.
  - e) Use transitional devices.
  - f) Employ appropriate, developed, and wide-ranging vocabulary.
- 4) Understand and use a recursive writing process to develop strategies for generating, revising, editing, and proofreading texts.
- 5) Produce rhetorically effective discourse for subject, audience, and purpose.
  - a) Organize a logically structured essay that includes an introduction, body, and conclusion.
  - b) Develop an essay's controlling idea (thesis or claim) with a balance of generalizations and adequate specific, illustrative details.
  - c) Use transitional devices to achieve coherency, unity, and focus.
  - d) Use a variety of rhetorical strategies to analyze and respond to topics and texts.
  - e) Support position using relevant evidence and a reasoned argument.

## **Appendix E: Exit-Level Course Competencies**

- f) Develop and employ a wide-ranging vocabulary appropriate for the argument's rhetorical purposes.
- 6) Demonstrate effective research and information literacy skills.
  - a) Formulate a [manageable] research question.
  - b) Access appropriate sources.
  - c) Evaluate and analyze information for credibility and accuracy.
  - d) Synthesize information from a variety of sources and apply the synthesis to complex situations and problems.
  - e) Cite primary and secondary sources using appropriate documentation style such as MLA, Chicago Manual, APA, etc.

## **Appendix E: Exit-Level Course Competencies**

### **4. Oral Communication/Public Speaking**

The standards outlined below reflect college course exit competencies for oral communication in research, writing, thinking, communication, expressive skills and presentation identified and recommended by a group community and four-year college communication instructors. Upon successfully completing the required oral communication course, students should be able to do the following:

- 1) Invention: Demonstrate the ability to use productive imagination for the discovery and evaluation of appropriate arguments relating to a chosen topic through effective research. That is to understand different aspects and points of view pertaining to the topic.
- 2) Through presentations skills students will demonstrate they understand the basic process of audience analysis by addressing the following:
  - a. Identify the target (and secondary) audience in terms of:
    - i. Demographics.
    - ii. Cultural concerns.
    - iii. Gender.
    - iv. Knowledge level of subject.
  - b. Understand the needs of that audience as it pertains to the presentation.
- 3) Students will be knowledgeable and able to use, identify, and create speeches for different types of speaking purposes, including:
  - a. Informing
  - b. Persuading
  - c. Entertaining
  - d. Motivational
- 4) Demonstrate effective preparation skills in the organization of speeches into three appropriate sections and preparing each section using the appropriate information and transitions between information and sections. These sections are:
  - a. Introduction
  - b. Body
  - c. Conclusion
- 5) Utilize and understand the patterns of organization to structure information for each specific type of speech. Students will use parallel ideas and information on different levels of abstraction in these patterns.
  - a. Chronological order - the time order in which events took place.
  - b. Cause to effect - show how your topic was the result of essential events.
  - c. Climax order - work from the least important information to the most important.
  - d. Anti-climax order - work from the most to least important information.
  - e. Spatial order - describe the physical setup of your topic.

## **Appendix E: Exit-Level Course Competencies**

- 6) Students demonstrate effective skill at composing and developing arguments with appropriate support that is unified, coherent, and fully developed utilizing the tenets of good writing and research.
  - a. Formulate a focused [manageable] topic sentence or thesis statement.
  - b. Access appropriate sources.
  - c. Evaluate and analyze information for credibility and accuracy.
  - d. Synthesize information from a variety of sources and apply the synthesis to complex situations and problems.
  - e. Use a variety of rhetorical strategies to analyze and respond to topics and texts.
  - f. Support position using relevant evidence and a reasoned argument.
  - g. Develop and employ a wide-ranging vocabulary appropriate for the argument's rhetorical purposes.
- 7) Students will understand the complex issue of good delivery and show improved personal confidence and the ability to manage communication apprehension. Increased competencies will be demonstrated in:
  - a. Verbal skills.
  - b. Non-verbal components.
  - c. Articulation, vocal variety, rate, pitch, tone, and enthusiasm.
  - d. Appropriate speaking persona.
  - e. Credibility, confidence , managing apprehension.
  - f. Tie speaking skills into audience listening.
  - g. Critique of ones own speaking persona.
- 8) Students will demonstrate effective listening skills as it relates to critical understanding of speech topics and critique of that speaking, doing the following:
  - a. Critical thinking and comprehension of speech topics.
  - b. Attending and listening with an open mind free of judgment.
  - c. Distinguishing between logical and emotional appeals.
  - d. Recall of information.
  - e. Evaluation of information and logical organization of presentations.
- 9) Students will demonstrate that they understand and take part in ethical speaking and listening during presentations. Understanding communication ethics for both speech preparation and critiquing of peer speeches by:
  - a. Utilizing responsible research and citing sources.
  - b. Preparing speeches with integrity when dealing with information and sources.
  - c. Using emotional and logical appeals responsibly.
- 10) Students will demonstrate and understand the role of public speaking in citizenry and how public speaking can contribute to success in the classroom and society.

## **Appendix E: Exit-Level Course Competencies**

### **5. First Semester Foreign Language**

The standards outlined below reflect college first semester exit competencies and are equivalent to the ACTFL (American Council on the Teaching of Foreign Languages) Novice Mid level and the CEF (Common European Framework) A1 level, with the exception of the optional cultural knowledge section. In each respective section below, students will:

#### **I. Listening**

- 1) Understand short and simple conversations on familiar topics such as myself, family, and my immediate surroundings when spoken slowly and clearly.
- 2) Sometimes recognize cognates, affixes, and thematic vocabulary to help me understand live or recorded spoken language.

#### **II. Reading**

- 1) Understand familiar names, words, and very simple sentences, for example on notices and posters or in catalogues.
- 2) Understand basic questions on standardized forms well enough to give important information (name, date of birth, nationality).
- 3) Distinguish between questions, statements, and exclamations.

#### **III. Writing**

- 1) Write lists, very short messages, post cards, and simple notes.
- 2) Write simple sentences describing myself and others using memorized phrases on familiar topics such as self, family, and immediate surroundings.
- 3) Supply basic personal information, such as physical information and preferences, in simple forms.

#### **IV. Speaking**

- 1) Describe self with some hesitation using memorized words and phrases and can ask and answer simple questions on familiar topics such as self, family, and immediate surroundings.
- 2) Use simple phrases and sentences to describe where they live and people they know, making themselves understood by a sympathetic native speaker.

#### **V. Cultural Knowledge (OPTIONAL)**

- 1) Have increased knowledge and appreciation of a different culture.

Suggested topics for inclusion in a first-semester foreign language course (ex.: Italian)

- |  |   |
|--|---|
| 1. Italy and the world<br>2. Families and values in Italy<br>3. Geography, how to place people, regional differences, dialects | 6. Educational system<br>7. Spending money, bank system<br>8. Modern cities<br>9. Youth and their interests |
|--|---|

## **Appendix E: Exit-Level Course Competencies**

4. A typical day: work, play, daily habits, meals 5. Health issues	10. Art, artists, authors, films, TV, cartoons, comic books
--	--

## **Appendix E: Exit-Level Course Competencies**

### **6. College Algebra**

All institutions generally expect students should be able to:

- 1) Understand the concepts of functions and be able to apply the properties of functions and their graphs.
- 2) Understand the relationship between linear functions and straight lines and be able to apply such knowledge.
- 3) Understand the concept of piecewise-defined functions and be able to translate this knowledge to their properties and graphs.
- 4) Understand the concept of transformation (e.g., shifting, reflecting, stretching, shrinking) of functions and be able to recognize and apply such knowledge when graphing functions.
- 5) Understand the concept of combining functions and be able to perform these operations and recognize the resulted functions and their properties.
- 6) Understand the invertibility of functions and the relationship between functions inverse to each other, and be able to determine inverse functions when appropriate.
- 7) Understand the meaning of solutions to linear and rational equations and be able to solve such equations whenever appropriate.
- 8) Apply the acquired understanding and knowledge of functions to model appropriate real-world situations and draw mathematical conclusions.
- 9) Understand the concept of complex numbers and be able to perform operations involving them.
- 10) Understand the meaning of solutions to quadratics equations and be able to solve such equations.
- 11) Understand and recognize other types of equations and be able to apply previously acquired knowledge to solve such equations whenever appropriate.
- 12) Understand the meaning of solutions to linear and absolute value inequalities and be able to solve such inequalities whenever appropriate.
- 13) Understand the relationship between quadratic functions and parabolas, and able to connect such knowledge to quadratics equations.
- 14) Understand the properties and graphs of polynomial functions and be able to perform basic operations involving polynomials.
- 15) Understand the meaning of the Remainder Theorem and its application to evaluating polynomial functions. Understand the meaning of the Factor Theorem and its application to solving polynomial equations.
- 16) Understand the meaning of zeros of polynomial functions and their connection to the graphs of these functions.
- 17) Understand the importance of the Fundamental Theorem of Algebra, its application to polynomial equations, and its connection to complex numbers.
- 18) Understand the properties and graphs of rational functions and be able to generate appropriate information, including asymptotes.
- 19) Understand the meaning of solutions to polynomial and rational inequalities and be able to solve such inequalities whenever appropriate.
- 20) Understand the properties and graphs of exponential functions and be able to evaluate and graph such functions.

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- 21) Understand the relationship between logarithmic functions and exponential functions and be able to evaluate and graph such functions.
- 22) Understand the properties of logarithms and their relationship to exponentials. Be able to perform operations on logarithms.
- 23) Understand the meaning of solutions to exponential and logarithmic equations and be able to apply the inverse relationship between exponentials and logarithms to equations involving them whenever appropriate.
- 24) Understand the meaning of exponential growth and decay and apply the knowledge of exponential and logarithmic functions model two applications.
- 25) Understand the meaning of compound interest and apply the knowledge of exponential functions to model this application.

The following competencies are based on the elective topics and vary from institution to institution. Students should be able to:

- 1) Understand the underlining principle of variation and how it is used to model many applications.
- 2) Understand the meaning of solutions to linear systems of equations and be able to use effective ways to find and express possible solutions.
- 3) Understand the meaning of solutions to systems of nonlinear equations and be able to use effective ways to find and express possible solutions.
- 4) Understand the concepts of matrices and their inverses (if exist), matrix operations, determinants, and be able to perform required computations. Understand how matrices are used to model and solve system of linear equations and be able to perform required appropriate computations.
- 5) Understand the properties and graphs of parabolas, ellipses, and/or hyperbolas and be able to perform basic related algebraic/graphing operations.
- 6) Understand the concepts of sequences and series (including the arithmetic and geometric cases) and their applications. Be able to perform basic related algebraic tasks.

## **Appendix E: Exit-Level Course Competencies**

### **7. General Geology**

Introductory Geology is a valuable tool for teaching the nature of science and how science advances given that the change in paradigm is well-known (for example, plate tectonics) and the relationship between progress in science and invention of new technologies is clear (for example, seismology). However, while the use of a geology course for teaching the nature of science necessitates teaching some basic geologic concepts, this approach greatly minimizes the required learning of specific, detailed subtopics within geosciences. Below are the basic geologic concepts that are essential to understanding the nature of science as taught in geology. For each, students should be able to:

#### I. Tectonics.

- 1) Describe the evidence leading to the Theory of Plate Tectonics.
- 2) Describe the interior structure of the earth.
- 3) Interpret the distribution of earthquakes, volcanoes, mountain building, etc. in terms of the Theory of Plate Tectonics.
- 4) Recognize geologic structures produced by tectonic forces.

#### II. Earth Materials

- 1) Describe the processes involved in the Rock Cycle.
- 2) Describe the properties of minerals used in their identification.
- 3) Explain how rocks are classified using criteria such as composition and texture; know how this process would apply to the most common types of igneous, metamorphic and sedimentary rocks.

#### III. Surface Processes

- 1) Describe the various processes in the decomposition of rock.
- 2) Describe how materials are eroded, transported and deposited (e.g. by water, wind, ice, gravity).
- 3) Explain how erosion, transportation and deposition produce and/or modify landforms.
- 4) Describe the interaction between surface water and groundwater.
- 5) Evaluate the earth-human interaction.

#### IV. Geologic Time

- 1) Recognize major earth events in the framework of geologic time.
- 2) Differentiate between absolute and relative dating.
- 3) Describe and apply the principle of uniformitarianism.
- 4) Explain how the concepts of faunal succession and stratigraphic correlation have been used to develop the geologic time scale.

## **Appendix E: Exit-Level Course Competencies**

### **8. Introduction to Astronomy**

Introductory Astronomy provides an ideal tool for teaching the nature of science and the scientific method. In particular, the paradigm shifts are well-known (e.g. geocentric vs. heliocentric models of the solar system) and the relationship between progress in science and invention of new technologies is clear. However, while the use of an astronomy course for teaching the nature of science necessitates teaching some basic physics concepts, it does not require specific subtopics within astronomy to be learned.

What follows is a list of both the physics concepts and astronomical topics that are deemed essential to an astronomy course whose aim is to convey the nature and methods of science.

#### **I. Physics Concepts**

The first exit competency must be to specify which physics concepts are essential to understanding the nature of science as taught in astronomy. They include:

- 1) Newton's laws
- 2) the nature of light (both waves and particles)
  - a) color, wavelength and energy
  - b) Doppler effect
- 3) electronic structure of atoms
- 4) spectroscopy and the relationship between (2) and (3)
- 5) blackbody radiation

In all cases, students should be able to demonstrate an understanding of the concepts and the meaning of the equations, though a rigorous mathematical understanding of formulas is not necessary. That is, they should know that the gravitational force between two bodies is proportion to the masses and inversely proportional to separation squared; they should know that the nature of a blackbody is such that the total power output is proportional to both the size (radius) and the temperature of an object, but that the effect of temperature is stronger than that of size.

#### **II. Astronomical Concepts**

- 1) Students should be able to explain how the motion of astronomical objects is viewed across the sky on various timescales (e.g. daily, monthly, yearly, etc.). Students should:
  - a) Know how these apparent motions are manifest themselves in terms of seasons and lunar phases.
  - b) Know that scientific relevance of the Zodiac constellations is simply that these constellations define the ecliptic plane (where the sun and planets travel on the sky).
- 2) Students should know the properties of planetary motion as described by Newton's Laws and Kepler's Laws. They should know how these properties allow us to derive planetary (and in fact stellar) masses.

## **Appendix E: Exit-Level Course Competencies**

- 3) Students should know what the fundamental measurable properties of stars are, such as distance (where applicable), brightness, temperature, and derivable properties such as mass, radius, etc. They should:
  - a) Know how those properties are derived.
  - b) Know what the Hertzsprung-Russell diagram is and what can be represented on it (populations of stars, evolutionary paths of stars).
  - c) Know star nomenclature (main sequence, giant, supergiant, dwarf, etc.).
- 4) Students should know the hierarchical structure of the universe (solar system, galaxies, cluster galaxies, universe) and the methods of measuring astronomical scales (especially parallax and standard candles, but also Doppler shift and its relationship to Hubble's Law).
- 5) Students should know what Hubble's Law is and how it was determined. They should know how it can be used both to determine the history and to extrapolate the probable evolution of the universe.

## **Appendix E: Exit-Level Course Competencies**

### **9. Introductory Biology**

This document is designed to facilitate the transfer of general education credit for undergraduate, non-majors' biology lecture courses among institutions in the State of Missouri.

All biology lecture courses designed for non-science majors should help students:

1. Develop an understanding of how science is conducted.
2. Develop an understanding of basic biological concepts necessary for biological literacy.
3. Apply higher-level thinking to biology concepts, with emphasis placed on those skills and content needed by educated citizens.
4. Explore biological issues of concern to the public, forming a foundation for life-long learning on scientific issues.

It is expected that faculty teaching an introductory biology course for non-majors will address each of the eight concepts described below. Various approaches are appropriate for teaching each concept. *This document provides suggested objectives, but it is not required that every objective be achieved for every concept.*

These competencies are not designed to limit the topics in college biology to these eight concepts, but is rather a foundation upon which other topics may be added at the instructor's discretion.

Some aspects of this document were taken either directly or indirectly from the following sources:

- Summary of Group Goals for Introductory Biology from the Missouri Alignment Project: Life Sciences Discipline Workgroup, as summarized by Deborah Allen.
- MIT Hierarchical Introductory Biology Concept Framework (<http://web.mit.edu/bioedgroup/HBCF/CBE-Summer2004.html>)
- Quality in Undergraduate Education – Standards for a Non-Majors Biology Course (<http://www2.gsu.edu/~wwwque/standards/biology/biologynonmajors.html>)

1) Biology is a scientific discipline based on observations and experiments.

Objectives to support this concept may include:

- a) Judge the validity of science found in popular media based on the source, methodology used to investigate the science, and the conclusions drawn from the results.
  - b) Read and discuss scientific material written for the educated lay reader.
  - c) Explain that scientific knowledge is cumulative and subject to changes in interpretation based on new evidence.
- 2) At the molecular level, biology is based on interactions of three-dimensional molecules and life processes are the result of regulated chemical reactions.

Objectives to support this concept may include:

## **Appendix E: Exit-Level Course Competencies**

- a) Explain why each of the four major categories of organic molecules (carbohydrates, lipids, nucleic acids, proteins) is required for living systems.
  - b) Recognize that the metabolism of living things is a series of chemical reactions that transfers energy and atoms between molecules.
  - c) Apply an understanding of a molecule's 3-dimensional shape to molecule function (e.g. tertiary protein structure to enzyme function).
- 3) The cell is the basic unit of life.
- Objectives to support this concept may include:
- a) Determine if an object is living or non-living, prokaryotic or eukaryotic, plant cell or animal cell based on identifying characteristics.
  - b) Explain how different parts of the cell contribute to characteristics common to all living things.
  - c) Interpret the statement, "Cells arise from other cells," using cellular reproduction as evidence.
- 4) The structure of DNA guides its own replication, the production of proteins, and the transmission of information to future generations.
- Objectives to support this concept may include:
- a) Describe how the structure of DNA makes it possible for identical copies to be made when cells replicate.
  - b) Draw and/or explain the relationship between DNA molecules, chromosomes, genes, alleles and genomes.
  - c) Explain that genes are segments of DNA with information for making a protein and that the sequence of bases in that DNA segment dictates the sequence of amino acids in the protein.
  - d) Apply an understanding of gene expression to explain why most somatic cells in an individual have the same genetic information, but are structurally and functionally different.
  - e) Integrate an understanding of genes and protein synthesis to explain why a mutation can change the resulting protein.
  - f) Explain that versions of genes (alleles) are sources of variation in a population and the source of inheritable genetic diseases.
  - g) Relate gene expression and phenotype.
- 5) The physiology of multicellular organisms involves interactions among different levels of organization.

Objectives to support this concept may include:

- a) Describe the relationship between the following levels of organization: molecule, organelle, cell, tissue, organ, organ system, and organism.

## **Appendix E: Exit-Level Course Competencies**

- b) Explain how changing a fundamental physiological process at the molecular level will impact the other levels in the organizational hierarchy (e.g., cystic fibrosis, photosynthesis, etc.)
  - c) Define and give examples of homeostasis.
  - d) Explain how physiological development is controlled by carefully synchronized chemical signals.
- 6) Organisms interact with each other and the environment.

Objectives to support this concept may include:

- a) Give examples of the interdependency of biotic and abiotic components of ecosystems (e.g. nutrient cycling, energy flow, etc.).
- b) Describe the impact of human activity on the environment and how this impact may drive biological change, loss of habitat, and/or species extinction.
- c) Describe a) how human activities contribute to the greenhouse effect, b) the consequences of global climate change, and c) strategies for mitigating these effects.
- d) Explain the relationship between the following levels of organization: organism, population, communities, ecosystems and biosphere.

7) The Theory of Evolution is the central unifying theme of biology.

Objectives to support this concept may include:

- a) Recognize that the Theory of Evolution explains both the universal characteristics of organisms as well as the diversity of life on Earth.
- b) Explain the importance of variation in a population.
- c) Identify sources of genetic variation (e.g., mutation, genetic recombination during meiosis, and sexual reproduction).
- d) Define evolution as a change in allele frequency.
- e) Explain and give examples of natural selection as the primary mechanism of evolution.
- f) Explain how various tools (e.g., fossil record, radiometric dating, gene modification, comparative morphology, etc.) are used to determine the relationships among species.
- g) Interpret the relationships among organisms in a phylogenetic tree.

8) Biology and society impact each other.

Objectives to support this concept may include:

- a) Explain how science and technology impact society, as well as how scientists are influenced by the political, social, economic and cultural influences of the time.
- b) Demonstrate a basic understanding of common biotechnology tools (e.g., Recombinant DNA Technology, restriction enzymes, DNA Fingerprinting, Somatic Cell Nuclear Transfer) and explain how the use of these tools has influenced social, cultural, or political issues.
- c) Examine both sides of conflicting opinions on bioethical issues.

## **Appendix E: Exit-Level Course Competencies**

### **10. Introduction to Chemistry (One Semester Course)**

I. The Scientific Method. The student should be able to demonstrate that:

- 1) Science is a process.
- 2) Science is based on observations made in the physical world (data).
- 3) Hypotheses are made based on these observations.
- 4) Hypotheses are tested creating new data and probably new hypotheses.
- 5) Laws are summary statements of a large number observations.
- 6) Theories are statements that explain observations and predict future observations.
- 7) Theories and Laws are subject to change; that Theories and Laws must be supported by the data.

II. Atoms and the Periodic Table. The student should be able to:

- 1) Apply appropriate units to express various measurements.
- 2) Use the method of dimensional analysis to systematically convert from one unit to another.
- 3) Use the Law of Conservation of Mass and Energy.
- 4) Quantify the three fundamental particles in any atom, isotope, or ion.
- 5) Apply the significance of the electron configuration within an atom or ion and the position of an element on the periodic table.

III. Compounds, Formulas, Reactions, and Equations. The student should be able to:

- 1) Classify elemental, ionic, and covalent substances and relate a systematic name to a formula.
- 2) Recognize various reaction types and construct a balanced equation describing the formation of products from reactants.
- 3) Use a periodic table and a balanced chemical equation to convert (reversibly) between mass to moles of a substance and mole to mole conversions for various changes.
- 4) Apply the concept of limiting reactants and the nature of chemical analysis.
- 5) Construct working Lewis structures for simple covalent compounds. Classify types of chemical bonding.

IV. Behavior of the States of Matter. The student should be able to:

- 1) Use the kinetic-molecular theory to explain the behavior of gases.
- 2) Relate the effect of pressure, volume, temperature, or amount changes as stated by the Ideal Gas Equation.
- 3) Recognize the nature of intermolecular forces of attraction and their effect on the physical properties of substances.
- 4) Predict Hydrogen Bonding and the unique physical properties it manifests in water and other biomolecules.
- 5) Determine the energy transfer involved with varying temperature and changes in state using measured conversion factors.

## **Appendix E: Exit-Level Course Competencies**

V. Properties of Solutions. The student should be able to:

- 1) Use the concept of intermolecular forces to explain the action of solvation of an ionic or covalent solute.
- 2) Use dimensional analysis to systematically convert from one unit to any other with concentration units as a connection.
- 3) Use the concepts of mass percent, parts per million, molarity, molality, and mole fraction.
- 4) Translate a chemical change in a solution into a net ionic equation which discounts the presence of spectator ions.
- 5) Characterize the simple action of acids and bases and the nature of the pH scale.

VI. Equilibrium, and Oxidation and Reduction. The student should be able to:

- 1) Predict that chemical reactions go to an equilibrium state.
- 2) Assign the oxidation states for each element within a formula.
- 3) Identify oxidation and reduction reactions.
- 4) Identify oxidizing agents and reducing agents.

## **Appendix E: Exit-Level Course Competencies**

### **5) American Government**

The purpose of the American government course at Missouri colleges and universities is to prepare students to be competent citizens who understand and are capable of participating in the political processes of the nation. Upon successful completion of the course, the student will:

1. Understand of the environment of the American political system by examining the political ideologies and theories of democracy that influenced the construction of our system of government.
2. Outline the structure of our government, as set up in the Constitution.
3. Describe the links between citizens and government. In this, they should articulate key concepts about voting, political parties, campaigns, and other forms of political participation.
4. Understand (1) the structure and interactions of the presidency, congress, bureaucracy, and courts and (2) how the institutions are intended to respond to citizen inputs.
5. Understand practices and processes that describe how governmental institutions work and interact to create domestic and foreign policy.

We recognize there will be variation in emphasis by instructor, but the preceding goals, if met, will provide a student who completes the course with a grade of C or better with the minimum level of knowledge that we expect of a competent citizen and of students who enter our upper division courses. At the end of the day, students should walk away with a holistic picture of the varied institutions and practices in our system, which allows them to understand these as solutions, albeit imperfect ones, to problems of governance in this country.

These goals can be met if the content of each course covers the following topics and students are tested on their knowledge of this material.

#### **I. The Environment of our System**

- 1) Origins of the American System. Students will:
  - a) Define the word “politics.”
  - b) Define “ideology” and its component parts, beliefs and values.
  - c) Identify the key components of three classic ideologies (Classical Conservatism, Classical Liberalism, Classical Socialism).
  - d) Explain what Classic Liberalism is, why it is the “American” ideology, and why it makes the United States unique as the world’s most classically liberal nation.
  - e) Understand the difference between a democracy and a republic  
Understand the contributions of Rousseau, Locke, Montesquieu, and Newton to the American version of democracy.

## **Appendix E: Exit-Level Course Competencies**

- 2) The Constitution. Students should be able to:
  - a) Understand the weaknesses of our first national government, the Articles of Confederation and why certain leaders felt it was necessary to create a new government (patriots, merchants)
  - b) Understand that the framers of the Constitution were pragmatic politicians who in large part drafted the Constitution to solve practical problems of governance, identify the key parts of the Constitution, both in the main body and the Amendments (the 7 articles and, at a minimum, the first 10 amendments and the Civil War Amendments).
  - c) Identify the major sections of the Missouri Constitution (especially Articles 1-4 and 12).
- 3) Federalism. Students should be able to:
  - a) Define federalism and understand why it was included in the Constitution.
  - b) Describe the clauses in the Constitution relevant to the power of the central government in the state-federal relationship (supremacy clause, full faith and credit, privileges and immunities, elastic, commerce, etc.).
  - c) Describe the clauses in the Constitution relevant to the power of the state governments in the state-federal relationship (enumerated powers, 10<sup>th</sup> amendment, 11<sup>th</sup> amendment, etc.).
  - d) Explain the importance of *McCulloch v. Maryland*.
  - e) Explain the concept of “devolution” in the state-federal relationship.
  - f) Understand the modern relevance of federalism and its implications.

## **II. Links between the Government and the Governed**

- 1) Political Participation. Students should be able to:
  - a) Define political participation.
  - b) Understand why some people are more likely to participate in politics than others.
  - c) Explain why Americans, in general, participate at lower rates than people in other democratic countries (most nations have very different political party systems).
  - d) Explain why Americans now participate at lower rates than Americans of forty years ago (should include possible explanations as well as the argument that the decline in participation is overblown).
  - e) Understand why some interest groups are more “successful” than others (explain the difference between economic interest groups and public interest groups). Identify the ways in which interest groups influence the policymaking process (lobbying, grassroots lobbying, etc.).
- 2) Public Opinion and the News Media. Students should be able to:
  - a) Explain the role public opinion should play in governing a representative democracy (be conversant with the terms “delegate,” “trustee,” and “politico”).
  - b) Describe the possible flaws in public opinion polling and how to be a careful consumer of such polls (understand sampling, question wording, survey design, margin of error).
  - c) Describe the problems with the coverage of politics by the news media (overemphasis on scandal and sensational events).

## **Appendix E: Exit-Level Course Competencies**

- d) Explain how politicians use the news media (use of staged events, trial balloons and leaks, extensive PR staff).
  - e) Explain how the news media have changed politics (image over substance).
- 3) Political parties. Students should be able to:
- a) Define a political party and distinguish it from an interest group.
  - b) Explain the functions served by parties in a representative democracy.
  - c) Describe how the Progressive Era reforms and how they weakened parties in the United States.
  - d) Explain the difference between the difference between choosing representatives from single member, simple plurality districts (and states in the case of Senators) and proportional representation.
  - e) Explain why we have a predominantly two -party system in the United States.
  - g) Describe the role third parties have historically played in the United States.
- 4) Campaigns. Students should be able to:
- a) Explain the criteria for a good election (turnout, absence of fraud and demagoguery, be informational, influence what government does).
  - b) Analyze recent elections by the criteria for a good election.
  - c) Explain what the Electoral College is and how it works.
  - d) Understand the current state of campaign finance law in the United States (should know the FECA amendments of 1973, Buckley v. Valeo, Bipartisan Campaign Reform Act, McConnell v. FEC, more recent developments).

### **III. Institutions and Issues**

Congress. Students should be able to:

- a) Explain the local orientation of members of Congress (which means that they should know Congress is better at serving local interests than the national interest and why that is the case).
  - b) Describe the structure of the House and Senate.
  - c) Understand the process of how a bill becomes a law.
  - d) Know that the passage of the annual budget is Congress's biggest job and know how that process works.
- 2) Executive Branch. Students should be able to:
- a) Know who can legally become president and contrast it with the far more limited (demographically) group of people who have actually served as president.
  - b) List the functions, or jobs, of the president.
  - c) Distinguish between the formal (constitutional) and informal (evolved) powers of the president.
  - d) Explain why the president is much more effective as a foreign policy leader than a domestic policy leader.
- Understand the characteristics and functions of the bureaucracy, as well as the manner in which it fits into a democratic society.

## **Appendix E: Exit-Level Course Competencies**

- 3) The Courts. Students should be able to:
  - a) Explain the primary function (adjudicating) and primary objective (protect civil liberties) of courts.
  - b) Answer important questions about the design of the federal judiciary through an understanding of Hamilton's Federalists papers on the subject (why permanent tenure in office, why selection by the president and confirmation by the senate, why a small, collegial court).
  - c) Describe the design of the federal judiciary (district, circuit, supreme courts); understand how the Supreme Court functions.
  - d) Define judicial review and be able to explain the importance of *Marbury v. Madison*.
  - e) Understand the factors which influence Supreme Court decisions (the Constitution, the law, personal views of the justices, public opinion).
  - f) Know the limits on the power of the Supreme Court (the president, the Congress, the Constitution, judicial restraint).
  - g) Explain the difference between civil rights and civil liberties.
  - h) Define selective incorporation.
  - i) Identify the constitutional amendments that bear on our most important right, voting (15, 17, 19, 23, 24, 26).
- 4) Policy. Students should be able to:
  - a) Explain what type of economic system the United States has.
  - b) Explain why the government is involved in regulating the economy.
  - c) Explain the difference between fiscal and economic policy.
  - d) List the foreign policy goals of the United States.
  - e) Describe the process of making foreign policy in a democracy.
  - f) Differentiate between the country's military and economic tools for making foreign policy.
  - g) Understand the ways in which political institutions and the attitudes of the general public interact in the production of both foreign and domestic policy.

## **Appendix E: Exit-Level Course Competencies**

### **12. Introduction to Psychology**

The American Psychological Association's *Guidelines for the Undergraduate Psychology Major* was a primary resource in the development of these competencies. For all of the following, students should:

#### **I. Knowledge Base of Psychology**

- 1) Explain why psychology is a science
- 2) Identify the components of current perspectives in psychology and trace their historical roots.
- 3) Gain awareness of ongoing themes in the field of psychology, for example:
  - a) nature and nurture
  - b) the interaction of mind and body
  - c) free will and determinism

#### **II. Research Methods in Psychology**

- 1) Distinguish between major methods of psychological research.
- 2) Recite steps in conducting psychological research.
- 3) Identify and critique research reported in popular literature.
- 4) Recognize potential sources of bias.
- 5) Recognize common descriptive statistics used in psychology.
- 6) Identify ethical concerns in conducting psychological research.

#### **III. Critical Thinking Skills in Psychology**

- 1) Identify limitations of generalizing research.
- 2) Challenge claims that arise from myth, stereotype, or untested assumptions by using scientific principles and evidence.

#### **IV. Application of Psychology**

- 1) Describe major applied areas of psychology.
- 2) Identify practical applications of psychology.
- 3) Identify applications of psychology as applied to areas such as:
  - a) health and medicine
  - b) environment
  - c) education
  - d) public policy

#### **V. Sociocultural and International Awareness**

- 1) Recognize that psychology is an international discipline.
- 2) Provide examples of how interaction among diverse people can challenge conventional understanding of psychological processes and behavior.

## **Appendix E: Exit-Level Course Competencies**

### **13. US History to/from 1877**

These exit competencies are applicable for Introductory US History Courses, to or from 1877. Upon successful completion of the course, students should be able to:

- 1) Understand significant trends, movements, and events in American history.
- 2) Identify and interpret primary and secondary sources, placing them in the context of their time and place and assessing them for reliability and point of view.
- 3) Formulate historical arguments based on specific evidence from the sources
- 4) Demonstrate an understanding of historical chronology and respect the distinctive integrity of the past.
- 5) Appreciate the multiple political, social, economic, and cultural dimensions of the human experience.
- 6) Use historical analysis to evaluate cause and effect, comparisons and contrasts, and patterns of continuity and change over time.

## Appendix F: Alignment Matrix Example—Freshman Composition Sequence

### **42-Hour Block General Education Skill Areas**

#### **a. Communicating**

State-Level Goal: To develop students' effective use of the English language and quantitative and other symbolic systems essential to their success in school and in the world. Students should be able to read and listen critically and to write and speak with thoughtfulness, clarity, coherence, and persuasiveness.

<b>Illustrative General Education Competency</b>	<b>First Course: Freshman Composition Sequence</b>
analyze and evaluate their own and others' speaking and writing. conceive of writing as a recursive process that involves many strategies, including generating material, evaluating sources when used, drafting, revising, and editing.	<p>1.g: Analyze and evaluate their own and others' speaking and writing      2.d: Communicate with few errors in grammar, usage, diction, and mechanics      3.d: Select and use appropriate patterns of organization for subject audience, and purpose  <b>4—Understand and use a recursive writing process to develop strategies for generating, revising, editing, and proofreading texts</b></p>
make formal written and oral presentations employing correct diction, syntax, usage, grammar, and mechanics.	<p><b>2—Compose sound and effective sentences:</b>      2.a: Use a variety of sentence structures correctly;      2.b: Understand and employ subordination and coordination to express ideas      2.c: Avoid major sentence-level errors such as fragments, comma splices, fused sentences, etc.      2.d: Communicate with few errors in grammar, usage, diction, and mechanics  <b>3—Compose unified, coherent, and developed paragraphs:</b>      3.a: Write focused topic sentences      3.b: Maintain focus and unity of paragraph      3.c: Use details, examples, and facts to develop the paragraph's main idea      3.d: Select and use appropriate patterns of organization for subject audience, and purpose      3.e: Use transitional devices      3.f: Employ a appropriate, developed, and wide-ranging vocabulary</p>
focus on a purpose (e.g., explaining, problem solving, argument) and vary approaches to writing and speaking based on that purpose.	<p>1.c: Identify purpose, main idea, and supporting evidence      1.a: Maintain focus and unity of paragraph      3.d: Select and use appropriate patterns of organization for subject audience, and purpose  <b>5: Produce rhetorically effective discourse for subject, audience, and purpose:</b>      5.a: Organize a logically structured essay that includes an introduction, body, and conclusion      5.b: Develop an essay's controlling idea (thesis or claim) with a balance of generalizations and adequate specific, illustrative details      5.c: Use transitional devices to achieve coherency, unity, and focus      5.d: Use a variety of rhetorical strategies to analyze and respond to topics and texts      5.e: Support position using relevant evidence and a reasoned argument      5.f: Develop and employ a wide-ranging vocabulary appropriate for the argument's rhetorical purposes.</p>
respond to the needs of different venues and audiences and choose words for appropriateness and effect.	<p>5.d: Use a variety of rhetorical strategies to analyze and respond to topics and texts      5.f: Develop and employ a wide-ranging vocabulary appropriate for the argument's rhetorical purposes.</p>
communicate effectively in groups by listening, reflecting, and responding appropriately and in context.	<p>1.g: Analyze and evaluate their own and others' speaking and writing      1.h: Communicate effectively in groups by listening, reflecting, and responding appropriately</p>

## Appendix F: Alignment Matrix Example—Freshman Composition Sequence

<b>Illustrative General Education Competency</b>	<b>First Course: Freshman Composition Sequence</b>
use mathematical and statistical models, standard quantitative symbols, and various graphical tactics to present information with clarity, accuracy, and precision.	

### **b. Higher-Order Thinking**

State-Level Goal: To develop students' ability to distinguish among opinions, facts, and inferences; to identify underlying or implicit assumptions; to make informed judgments; and to solve problems by applying evaluative standards.

<b>Illustrative General Education Competency</b>	<b>First Course: Freshman Composition Sequence</b>
recognize the problematic elements of presentations of information and argument and to formulate diagnostic questions for resolving issues and solving problems.	1.d: Distinguish between fact and opinion and recognize textual biases 1.i: Formulate diagnostic questions for resolving issues and identify possible solutions 6.c: Evaluate and analyze information for credibility and accuracy
use linguistic, mathematical or other symbolic approaches to describe problems, identify alternative solutions, and make reasoned choices among those solutions.	1.i: Formulate diagnostic questions for resolving issues and identify possible solutions 1.j: Show an awareness of the different modes of comprehension, as well as expression, required for effective oral communication, as opposed to written. 5.d: Use a variety of rhetorical strategies to analyze and respond to topics and texts 5.e: Support position using relevant evidence and a reasoned argument <b>6—Demonstrate effective research and information literacy skills.</b> 6.a: Formulate a [manageable] research question 6.b: Access appropriate sources 6.c: Evaluate and analyze information for credibility and accuracy 6.d: Synthesize information from a variety of sources and apply the synthesis to complex situations and problems 6.e: Cite primary and secondary sources using appropriate documentation style such as MLA, Chicago Manual, APA, etc.
analyze and synthesize information from a variety of sources and apply the results to resolving complex situations and problems.	<b>6—Demonstrate effective research and information literacy skills.</b> 6.a: Formulate a [manageable] research question 6.b: Access appropriate sources 6.c: Evaluate and analyze information for credibility and accuracy 6.d: Synthesize information from a variety of sources and apply the synthesis to complex situations and problems 6.e: Cite primary and secondary sources using appropriate documentation style such as MLA, Chicago Manual, APA, etc.
defend conclusions using relevant evidence and reasoned argument.	<b>5—Produce rhetorically effective discourse for subject, audience, and purpose:</b> 5.a: Organize a logically structured essay that includes an introduction, body, and conclusion 5.b: Develop an essay's controlling idea (thesis or claim) with a balance of generalizations and adequate specific, illustrative details 5.c: Use transitional devices to achieve coherency, unity, and focus 5.d: Use a variety of rhetorical strategies to analyze and respond to topics and texts 5.e: Support position using relevant evidence and a reasoned argument 5.f: Develop and employ a wide-ranging vocabulary appropriate for the argument's rhetorical purposes. <b>6—Demonstrate effective research and information literacy skills.</b> 6.a: Formulate a [manageable] research question 6.b: Access appropriate sources

## Appendix F: Alignment Matrix Example—Freshman Composition Sequence

<b>Illustrative General Education Competency</b>	<b>First Course: Freshman Composition Sequence</b>
	<p>6.c: Evaluate and analyze information for credibility and accuracy      6.d: Synthesize information from a variety of sources and apply the synthesis to complex situations and problems      6.e: Cite primary and secondary sources using appropriate documentation style such as MLA, Chicago Manual, APA, etc.</p>
reflect on and evaluate their critical-thinking processes.	<p>1.d: Distinguish between fact and opinion and recognize textual biases      1.e: Distinguish between general and specific information      1.g: Analyze and evaluate their own and others' speaking and writing      1.i: Formulate diagnostic questions for resolving issues and identify possible solutions  <b>5—Produce rhetorically effective discourse for subject, audience, and purpose:</b>      5.a: Organize a logically structured essay that includes an introduction, body, and conclusion      5.b: Develop an essay's controlling idea (thesis or claim) with a balance of generalizations and adequate specific, illustrative details      5.c: Use transitional devices to achieve coherency, unity, and focus      5.d: Use a variety of rhetorical strategies to analyze and respond to topics and texts      5.e: Support position using relevant evidence and a reasoned argument      5.f: Develop and employ a wide-ranging vocabulary appropriate for the argument's rhetorical purposes.</p>

### **c. Managing Information**

State-Level Goal: To develop students' abilities to locate, organize, store, retrieve, evaluate, synthesize, and annotate information from print, electronic, and other sources in preparation for solving problems and making informed decisions.

<b>Illustrative General Education Competency</b>	<b>First Course: Freshman Composition Sequence</b>
access and/or generate information from a variety of sources, including the most contemporary technological information services.	6.b: Access appropriate sources
evaluate information for its currency, usefulness, truthfulness, and accuracy.	6.c: Evaluate and analyze information for credibility and accuracy
organize, store, and retrieve information efficiently.	6.b: Access appropriate sources
reorganize information for an intended purpose, such as research projects.	6.d: Synthesize information from a variety of sources and apply the synthesis to complex situations and problems
present information clearly and concisely, using traditional and contemporary technologies.	1.j: Show an awareness of the different modes of comprehension, as well as expression, required for effective oral communication, as opposed to written.

### **d. Valuing**

State-Level Goal: To develop students' abilities to understand the moral and ethical values of a diverse society and to understand that many courses of action are guided by value judgments about the way things ought to be. Students should be able to make informed decisions through identifying personal values and the values of others and through understanding how such values develop. They should be able to analyze the ethical implications of choices made on the basis of these values.

## Appendix F: Alignment Matrix Example—Freshman Composition Sequence

<b>Illustrative General Education Competency</b>	<b>First Course: Freshman Composition Sequence</b>
compare and contrast historical and cultural ethical perspectives and belief systems.	n/a
utilize cultural, behavioral, and historical knowledge to clarify and articulate a personal value system.	n/a
recognize the ramifications of one's value decisions on self and others.	n/a
recognize conflicts within and between value systems and recognize and analyze ethical issues as they arise in a variety of contexts.	n/a
consider multiple perspectives, recognize biases, deal with ambiguity, and take a reasonable position.	1.d: Distinguish between fact and opinion and recognize textual biases 1.g: Analyze and evaluate their own and others' speaking and writing 6.c: Evaluate and analyze information for credibility and accuracy

### **42-Hour Block General Education Knowledge Areas**

#### **a. Social and Behavioral Sciences**

State-Level Goal: To develop students' understanding of themselves and the world around them through study of content and the processes used by historians and social and behavioral scientists to discover, describe, explain, and predict human behavior and social systems. Students must understand the diversities and complexities of the cultural and social world, past and present, and come to an informed sense of self and others. (Students must fulfill the state statute requirements for the United States and Missouri constitutions.)

<b>Illustrative General Education Competency</b>	<b>First Course: Freshman Composition Sequence</b>
explain social institutions, structures, and processes across a range of historical periods and cultures.	n/a
develop and communicate hypothetical explanations for individual human behavior within the large-scale historical and social context.	n/a
draw on history and the social sciences to evaluate contemporary problems.	n/a
describe and analytically compare social, cultural, and historical settings and processes other than one's own.	n/a
articulate the interconnectedness of people and places around the globe.	n/a
describe and explain the constitutions of the United States and Missouri .	n/a

#### **b. Humanities and Fine Arts**

State-Level Goal: To develop students' understanding of the ways in which humans have addressed their condition through imaginative work in the humanities and fine arts; to deepen their understanding of how that imaginative

## **Appendix F: Alignment Matrix Example—Freshman Composition Sequence**

process is informed and limited by social, cultural, linguistic, and historical circumstances; and to appreciate the world of the creative imagination as a form of knowledge.

<b>Illustrative General Education Competency</b>	<b>First Course: Freshman Composition Sequence</b>
describe the scope and variety of works in the humanities and fine arts (e.g., fine and performing arts, literature, speculative thought).	n/a
explain the historical, cultural, and social contexts of the humanities and fine arts.	n/a
identify the aesthetic standards used to make critical judgments in various artistic fields.	n/a
develop a plausible understanding of the differences and relationships between formal and popular culture.	n/a
articulate a response based upon aesthetic standards to observance of works in the humanities and fine arts.	n/a

### **c. Mathematics**

State-Level Goal: To develop students' understanding of fundamental mathematical concepts and their applications. Students should develop a level of quantitative literacy that would enable them to make decisions and solve problems and which could serve as a basis for continued learning. (The mathematics requirement for general education should have the same prerequisite(s) and level of rigor as college algebra.)

<b>Illustrative General Education Competency</b>	<b>First Course: Freshman Composition Sequence</b>
describe contributions to society from the discipline of mathematics.	n/a
recognize and use connections within mathematics and between mathematics and other disciplines.	n/a
read, interpret, analyze, and synthesize quantitative data (e.g., graphs, tables, statistics, survey data) and make reasoned estimates.	6.c: Evaluate and analyze information for credibility and accuracy
formulate and use generalizations based upon pattern recognition.	n/a
apply and use mathematical models (e.g., algebraic, geometric, statistical) to solve problems.	n/a

### **d. Life and Physical Sciences**

State-Level Goal: To develop students' understanding of the principles and laboratory procedures of life and physical sciences and to cultivate their abilities to apply the empirical methods of scientific inquiry. Students

## **Appendix F: Alignment Matrix Example—Freshman Composition Sequence**

should understand how scientific discovery changes theoretical views of the world, informs our imaginations, and shapes human history. Students should also understand that science is shaped by historical and social contexts.

<b>Illustrative General Education Competency</b>	<b>First Course: Freshman Composition Sequence</b>
explain how to use the scientific method and how to develop and test hypotheses in order to draw defensible conclusions.	n/a
evaluate scientific evidence and argument.	n/a
describe the basic principles of the physical universe.	n/a
describe concepts of the nature, organization, and evolution of living systems.	n/a
explain how human choices affect the earth and living systems.	n/a